new dimensions in photo processes

A Step-by-Step Manual

THIRD EDITION

Laura Blacklow

Focal Press

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New Dimensions in Photo Processes

A Step-by-Step Manual, Third Edition

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Preface

The writing of this book was undertaken almost by accident. While I was freelancing as an illustrator, I showed my portfolio of photo images to Lista Duren, an editor at Curtin & London Publishing Company. Ms. Duren brought the portfolio to Dennis Curtin, who, on the spot, asked me to write a book about the techniques represented. Curtin & London subsequently ceased publishing photography books, and so Focal Press picked up the manuscript.

I wish to acknowledge the work of the staffs at Curtin & London and Focal Press, as well as the enormous contribution of Virginia Holmes, who helped research and write the first draft. Gene Laughter, who was recommended to me by Karl Koenig, wrote the thorough Bromoil Printing section in Chapter 11 and was a delightful collaborator, even under pressure. I was fortunate that Gene could secure the photographic expertise of Wayne Firth, who took the step-by-step illustrations for that chapter. I appreciate being educated about chromoskedasic painting by Birgit Blyth, who, fortunately, did not make up that word. Elaine O'Neil assisted in organizing and refining the manuscript and helped write the section on toning.

Other people provided useful information: Seymour Rottenberg, vice-president of Kwik Proof; Robert Cone, manager of the Rockland Colloid Corporation; Bart DeVito at Luminos; Melody Bostick at Bostick & Sullivan; digital artist extraordinaire Carl Sesto; pinhole and collage artist Jesseca Ferguson; fabric artist Susan Podshadley; Robert Fairchild, electrician; Martyn Greenhalgh, who provided me with information on U.K. suppliers; and Neil Gordon, president of E.J. Ardon's (one of six graphic arts stores in the United States that are older than 50 years). S.B.I. Sales in Boston, Massachusetts, loaned me photo materials, the E. Philip Levine Company of Boston loaned photo equipment, and Agfa Corporation gave me photographs.

Thanks go to photographer David du Busc, whose patience and perfectionism helped produce clear step-by-step photographs; to Helen Snively, a most careful and accommodating typist who worked on the first edition; and to Sal Salerno, who tested my instructions. Barbara Hewitt and John Basye of Blueprints/Printables reviewed the cyanotype chapter and generously added information. Vicki Lewis thoroughly proofread the manuscript.

Gratitude is due the artists whose artwork enlivens these pages. I would like to acknowledge the many students in my classes, whose ideas and enthusiasm added immeasurably to the book.

I dedicate this book to my husband, Peter Fougere, whose support and feedback have proved invaluable, and to my son, Noah Fougere, who never put up too big a fight giving up the computer to accommodate his mother.

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INTRODUCTION

New Dimensions in Photo Processes presents techniques that combine painterly concerns with printmaking ideas, photographic principles, and graphic design tools. Painters, for instance, think about the articulation of an image by the physical application of materials and by the selection of a surface onto which the materials will adhere. Printmakers know different types of paper and the variations that can be achieved in a print while creating an edition. Photographers, used to the light sensitivity of certain substances, may think about the way a photographic technique can change the visual reading of a picture. Graphic designers and illustrators use special tools and procedures developed for their profession or borrowed from others. I hope this book will speak to professional artists, teachers, students, and hobbyists who employ technical methods and ideas from different image-making areas and will assist in the creation of more cogent visual statements.

Arising from a printmaking syntax,[1] photo imaging has always been affiliated with other art forms. In 1839, William Henry Fox Talbot invented a process related to Van Dyke brown prints (see Chapter 7) partly out of frustration with his unsuccessful attempts at drawing. You see, in nineteenth-century British society, part of a gentleman's education was learning how to draw. Talbot's first book, illustrated with *photogenic drawings,* as he called his photographic prints, was titled *The PENCIL of Nature* (emphasis mine). The 1844 edition included Talbot's drawings, his early experiments with laying objects atop sensitized paper to produce photograms, and his pictures taken with a hand-built camera fitted with a microscope lens (see illustration, pages 108–109). Talbot also wrote about the difference between visual reporting and visual expression—distinctions we still debate today.

Many methods described in this book were patented in the 1830s and 1840s. That period in Europe and England saw a proliferation of home inventors, spawned by the mass printing of illustrated books and magazines dealing with experiments in science and technology. Sir John Herschel, for example, developed the cyanotype technique (see Chapter 6) as a method for reproducing a small number of his mathematical charts. Soon after, architects and engineers adapted the process for blueprinting their drawings, and by the beginning of the twentieth century photographers were using the procedure for printing black-and-white negatives. (Herschel is also credited with coining the terms *photography, snapshot, negative,* and *positive.*[2])

[1] Jussim, Estelle. *Visual Communication and the Graphic Arts: Photographic Technologies in the 19th Century.* New York: R.R. Bowker, 1974.

[2] Gassan, Arnold. A *Chronology of Photography.* Athens, OH: Handbook Company, 1972, p. 23.

The business world adapted other photo-printmaking processes. The principle for gum bichromate printing was—and is—the basis for photo silkscreen, photolithography, and commercial offset printing. The gum arabic used for gum printing in 1839 was replaced later by bichromated gelatin. A coating of the light-sensitive gelatin on metal was exposed under a negative in print shops by 1850. Exposure and development hardened the gelatin (the positive), which was used to attract lithographic ink in commercial printing. A hardened gum-and-color-pigment positive is the finished product in a gum print.

Industrialization brought the mass production of factory-made photographic papers, films, and cameras. In 1898, George Eastman marketed the Kodak camera loaded with film, which could be used and then sent back to the Kodak factory by the photographer. The film was developed, prints were made, and the camera was reloaded with film. Eastman's method freed photographers from chemical manipulation and technical knowledge. Cyanotypes, Van Dyke brown, casein, and other hand-coated emulsions therefore lost favor with the public. These processes were not seen much until the 1960s and 1970s. Theories have been postulated about the reappearance of homemade photo techniques at a time when a significant segment of Western culture was revolting against the alienating aspects of technology.

I was additionally influenced by research into women's history, where handwork, especially on cloth, flourished. Most of these imaging techniques can be printed on fabric as well as paper, and instructions for imaging on both surfaces are explained in this book. Artists such as Betty Hahn and Bea Nettles exploited the possibilities of stitching photo imagery, and their manipulated images influenced other artists.

These antique processes can make new statements, as you will see by viewing the color plates. The picture maker does not need to have a sophisticated knowledge of chemistry, physics, or even photography. I have tried to write step-by-step directions that can be followed easily and without access to expensive equipment. It is hoped that the reader will enjoy learning these methods and that they will become second nature, so that the technical aspects are of little concern compared with the visual possibilities and the challenge from working creatively.

The title of this book has been changed from *New Dimensions in Photo Imaging*, the title of the first edition (1988) and second edition (1995), to *New Dimensions in Photo Processes* because now "photo imaging" has come to mean digital imaging. Also, the chapter on Kwik Print has been removed from the book because (as of Spring, 2000) the product is no longer manufactured. Kwik Print instructions, however, have been posted on the Focal Press website, www.focalpress.com/companions. There is a possibility that Kwik Print or a similar product will be picked up by another manufacturer.

The book is divided into three parts. Part I presents methods that can be carried out in daylight and are therefore called *light-insensitive* methods. Part II should be read before trying any of the light-sensitive methods. Chapter 4, Creating the Photo-Printmaking Studio, contains information on sizing paper, registering negatives, and building equipment such as an ultraviolet exposure unit. Chapter 5, Making Negatives, includes both photographic and nonphotographic techniques for making the image transparencies needed for printing. Part III consists of directions for eight light-sensitive processes. Some people refer to these methods as *nonsilver photography,* but the label is not entirely accurate. Silver nitrate is used in brown printing, for instance. The terms *alternative* and *nontraditional photography* are also used, because the hand-coated emulsions are seen more rarely than conventional black-and-white or color photographs. Given the previously described history of photo imaging, there is

some irony in these terms. Some processes, such as carbon printing and photogravure, are not included in this book because of their high cost or safety concerns. Books on these processes, however, are listed in the Bibliography.

The step-by-step procedures are separated from the rest of the text to allow you faster access to procedures for each technique—but always read the whole chapter before starting. The tips, for instance, will make your work sessions more enjoyable and productive.

It is imperative that you pay attention to the safety section within each chapter. Supply sources for needed equipment are listed in the back of the book. Please observe these symbols as you use this book:

Work in **daylight.** You can turn on room lights, and sunlight can illuminate the room.

Work in **subdued light.** You can use tungsten light or draw the blinds in your workspace during the day.

Work in **safelit conditions.** A safelight, available from a photography store, equipped with a Kodak Safelight Filter, number 1A (light red), a Kodak wratten OC (light amber) or equivalent, and a 15-watt bulb, should be placed no closer than 4 ft (1.25 m) to the emulsion. To make sure the safelight is not so bright as to cause fogging (exposing the film accidentally), run a fog test. On your work surface, put a piece of ortho film (see Chapter 5) or paper coated with liquid emulsion (see Chapter 12) and dried. Place two coins on top and leave them there for 3 to 5 minutes, or a time equivalent to how long it takes you to prepare a sheet. Then remove one coin and carefully position the sheet with the other coin under your enlarger. Shine a minimum of light, such as 1 second at f/16, on the sheet. Eliminate the second coin and develop the sheet. See if where the coins were remains clear (with duplicating film, it will be a black circle). If you see gray or black where the coins were, move your light further away or replace the bulb with one of weaker illumination.

Wear **protective gloves.** For these processes and for cleaning up, heavy chemically resistant gloves, such as neoprene gloves, are recommended. You can find them in a hardware store. Playtex now makes HandSaver gloves with latex and neoprene, which can be purchased at a grocery store. After a work session, wash the gloves and inspect them; if they appear damaged, replace them. Wash the inside and outside of the gloves with a slightly acidic hand cleaner such as pHisoderm™, then hang them inside out to dry. If the gloves are not cleaned properly, they can actually increase your exposure to dangerous chemicals—dirty gloves promote the absorption of contaminants through the skin. Wash your hands before leaving your workspace, even if you wore gloves.

Wear a **ventilating mask.** Please talk to your doctor before using a ventilating mask. If you can use one, make sure a knowledgeable person fits you. You will need a rubber half-mask air-purifying respirator with a filter for organic vapors and dusts and mists. You can choose between reusable or disposable respirators, but make sure that in the United States, you purchase one approved by MSHA. You can purchase masks at automotive paint and body shops, or good hardware and art stores. If you need help in selecting the right kind of respirator, consult insurance companies, the National Institute of Occupational Safety Hazards and

Occupational Safety Hazard Administration personnel in the United States and the Workplace Hazardous Materials Information Systems in Canada, respirator manufacturers and distributors, or the Art Hazards Information Center at the Center for Safety in the Arts in New York (see Bibliography, page 179). Keep in mind that respirators cannot be used if anything interferes with the seal of the facepiece against an individual's face, such as sideburns, beards, and eyeglasses. Store respirators in clean bags or other suitable containers in a clean and sanitary location. Inspect and maintain the respirator in accordance with the manufacturer's instructions. Pregnant women should not attempt any processes requiring a respirator because the mother's oxygen intake may be reduced, limiting the oxygen available to the fetus. If you have other health issues, such as heart problems, make sure you consult your doctor before using a respirator.

Don't just take my word for it; when ordering chemicals, ask for the Material Safety Data Sheet, which gives specific information on handling and storing each chemical in order to reduce your exposure, as well as information concerning first aid and protective equipment to wear.

Good health habits in the studio and darkroom are lifesavers. Never eat, drink, or smoke while handling chemicals. Keep your hands away from your face. Wear a special lab coat or water-proof apron while working, not your unprotected clothes. Avoid splashing chemicals; if you think a procedure will cause splashing, wear goggles to protect your eyes. (When in doubt, put on goggles–and mask–especially if you wear contact lenses.) Clean up spills immediately, preferably with paper towels. Throw paper towels and other refuse into a covered trash can or into a plastic bag. Seal the container and move it to an outdoor receptacle after your work session. Avoid mixing liquid and solid wastes.

Try to limit your chemical mixing and coating to one table with a non-porous top, such as glass. I cover my table with the Sunday newspaper unfolded. Each time chemicals contaminate the top sheet of paper, I throw it into a plastic trash bag, which I secure with a tie. I learned from The Palladio Co. that you can evaporate used liquid chemicals and dispose of the sludge as toxic waste, but don't evaporate in your small darkroom. The volume, once evaporated, will be small. Most towns have one or two days set aside for collection of such labeled materials. Fixer, used to enlarge negatives and stabilize brown prints, is toxic to marine life. Contact a university or commercial darkroom and ask if you can pour your used fixer through their silver recovery unit. Otherwise, flush chemicals down the drain with large amounts of water after reversing the order, such as exhausted fixer poured into used stop and both poured into "dead" developer in order to neutralize them first. Judy Siegel recommends cutting the narrow part of the spout off a large funnel (auto supply store) and inserting the spout into your drain to contain the flow during disposal of chemicals.

Keep all chemicals out of the reach of children and pets, and preferably in a locked cabinet away from heat and electric or other sparks. Most fire departments want to know the type and location of chemicals stored in your home.

Ventilation is necessary in the darkroom and the studio; an open window is *not* proper ventilation! Kodak recommends 10 room air changes per hour, but the Center for Occupational Hazards urges that a small work area change air at least 20 times per hour. To determine the size fan required, compute the size of the room (in cubic feet) by multiplying the length by width by height, then divide that figure by 6. Match that number to the fan's cfm rating.

Locate the exhaust fan so that vapors are pulled away from your face. Hence, the suggestion that you limit your chemical mixing and coating to one table becomes even more important. Because most vapors that result from photographic processes are heavier than air, it makes sense to install a vent near the floor or right where the vapors are released. Fresh air must enter the room in order for the ventilator to work properly. Cracks under the door or light-blocking vents (for a darkroom) are the solution.

If your workspace is also a living space, such as a bathroom, you need to be meticulous about your habits. Never use eating, storage, cleaning, or cooking utensils for making art, or vice versa. Separate chemically contaminated trash from household trash. If you must use your kitchen, limit your work to one area where you do not prepare or eat food.

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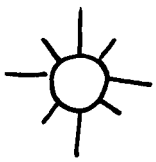
Part I LIGHT-INSENSITIVE METHODS

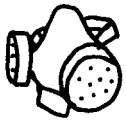


Daylight

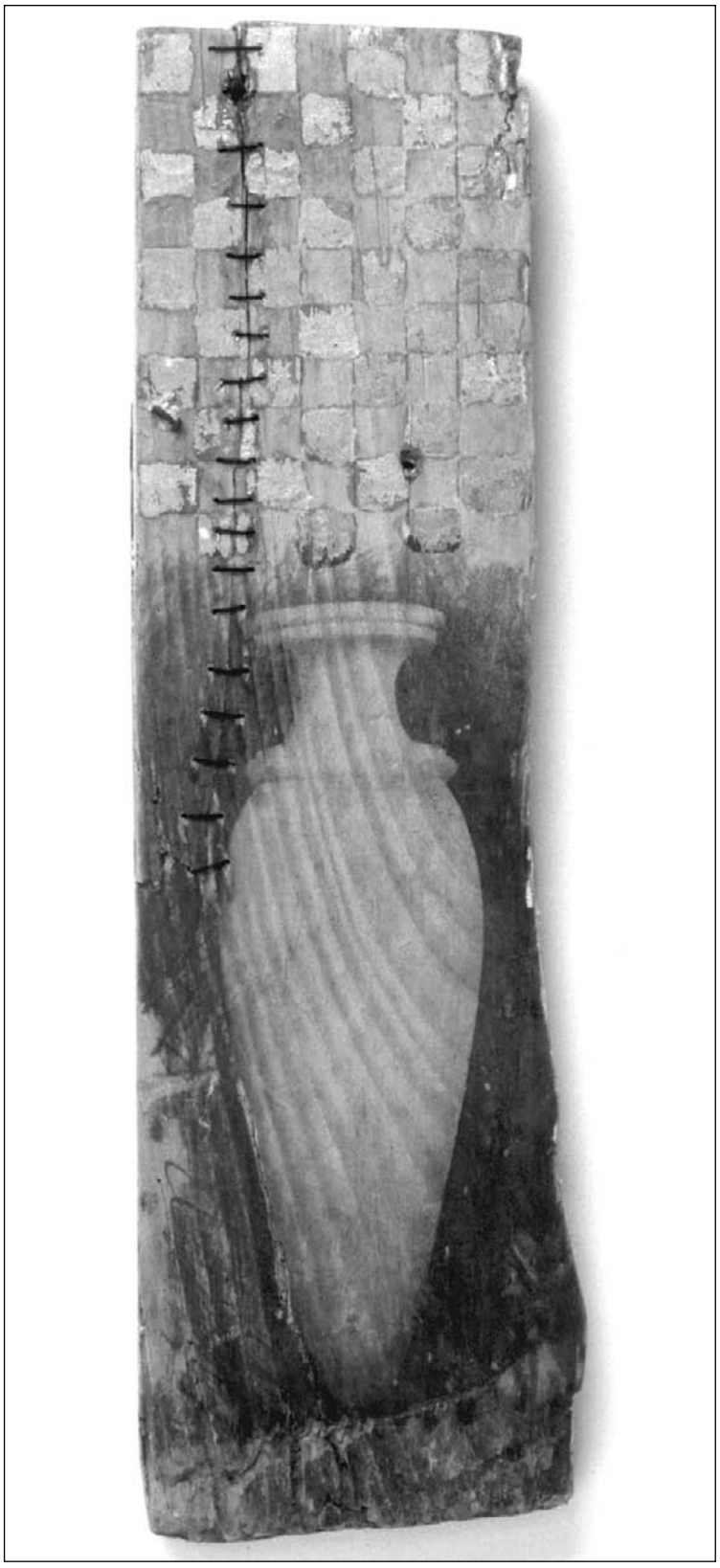
Subdued Light

Safelight

Protective Gloves



Respirator



Peter Madden, ***Checkerboard and Urn,*** **1 x 4 x 1 in. silver leaf, sewing, solvent transfer on found wood, 1998.**

Chapter 1 TRANSFERS AND LIFTS

Solvent Transfers

A fast and simple technique, *transferring* allows you to remove the image from a magazine, newspaper, or photocopy and relocate it to various surfaces such as paper, fabric, frosted acetate, drafting vellum, or lithographic stones or plates. Solvent and pressure combined dislodge the ink from the page and allow the image, without the original paper, to adhere to the receiving surface. Reproductions of photographs or drawings in black-and-white or color can be transferred. You can write or draw on a transferred image or on the receiving surface before transferring; you can sew into, mix media processes with, or tranfer one image on top of another. Because the inks are oil based and are not soluble in water, transfers on cloth remain permanent when washed in mild soaps.

Contemporary artist Robert Rauschenberg (see Plate I), whose work can be seen in major museums, has combined transfers with other media in his wall-mounted panel installations, lithographs, paintings on satin and silk, and drawings on paper. Rauschenberg's series *Dante's Inferno* exploits the gradations of tone achieved by changes in pressure from a ballpoint pen when making the transfer. Later, for his *Hoarfrost* series, Rauschenberg sprayed a fine solvent mist on smooth and crumpled printed images, which he sent through a lithograph press with natural fabrics underneath.

Safety

Be sure to work in a well-ventilated area, that is, a place that not only has an open window but also has 20 air changes per hour. Most solvents used in this process are highly flammable and noxious to breathe, irritating the eyes and respiratory passages, and have a narcotic effect on the nervous system. They also dry the skin and can cause serious damage to the kidneys and liver. If you use a citrus solvent, avoid contact with eyes and prolonged or repeated contact with skin.

Read all warning labels and wear neoprene gloves when handling solvents. Wear an organic solvent vapor mask when working in close proximity with solvents.

Immediately replace the cap or covering on solvent containers after use, and discard paper or other materials in a manner that prevents further release of the solvents into the air you are breathing.

Do not store solvents in inappropriate containers (e.g., solvent eats through styrofoam); use metal or glass containers. Isolate solvents from heat sparks, electrical equipment, oxidants, and open flames. Fumes tend to cling to the transfer after it is made, so air it out in a well-ventilated area away from your living space until the solvents have evaporated.

Solvent Transfers *(cont.)*

Method Overview

1 Printed page to be transferred is removed from source and prepared.

2 Solvent is applied to the back of the page.

3 Transfer of the image from the page is made by rubbing the back of the image, forcing the ink off the front onto the receiver.

Materials

1 Image. A photocopy, an inkjet-printed page, a magazine page, or a newspaper page will work well. Most magazines are printed on coated stock (clay-impregnated slick paper), which is very effective for transfers because the ink rests on the clay (kaolin), not on the paper. Make sure that the image to be transferred is not gravure printed or varnished (as are magazine covers, generally). The newer the publication, the fresher the ink and the easier the transfer will be. The thinner the paper, such as newspaper, the less solvent and pressure needed for transfer. Because you cannot transfer the same image material clearly more than once, copies of the same newspaper or magazine issue or photocopies of your own pictures offer an inexpensive source for multiple transfers. Expensive magazines tend to use finer reproduction methods, resulting in more detailed transfers. Even printed wallpapers can be used. I have started with a black-and-white photograph, which I put on a color photocopier and reproduced in any or all of the colors available on the copier, but you can also make copies from color slides and flat art. The copier's color balance and zoom functions add to your aesthetic choices, and you will find that some copiers accommodate sheet sizes of 11 × 14 in. (28 × 35.5 cm) or larger. Another way to create large images is to combine several small transfers into one larger image.

2 Metal spoon or etching or lithograph press.

3 Solvent. Only silkscreen supply stores carry transparent base. The inexpensive brand, Serascreen™ 174 W.W. Trans. Base, works best, but Naz Dar Transparent Base is easier to obtain. Use it on the *back* of the image. Pantone and Admarker, to name two companies, make blender pens for their permanent ink felt-tip markers. (A more detailed description of how to use these pens appears in the Tips section.) Oil of wintergreen or oil of lavender, citrus solvent (available at the Vermont County Store, listed in Supply Sources), fabric spot remover (such as Carbona™), lighter fluid, lacquer thinner, or offset blanket wash can be applied, but these are more difficult to work with because they evaporate more quickly. The best product I have used, Citra Solv, can be purchased in a hardware store. I poured it into an atomizer and lightly sprayed the back of the picture. Citrus solvents do not seem to pose health risks.

4 White scrap paper. Should be larger than the size of the transfer image. Typing (bond) paper is excellent.

5 Black permanent marker.

6 Scissors or stencil knife.

7 Tissues or paper towels.

8 Masking tape or drafting tape. Drafting tape is less sticky than masking tape and will not rip artwork when removed. To make masking tape less sticky, press the tape onto a piece of cloth before using it.

9 Hard, smooth work surface. Imperfections in your table or desk will show in the transfer.

10 Plastic bags. For solvent trash. To prevent continued release of solvent vapors into the air you breathe, wrap up and dispose of used materials.

11 Light table or window with daylight. To draw an outline of where to apply the solvent on the back of the page, you need to hold the image up to a light and to be able to see through from the front to the back.

12 Receiver. Almost any paper or fabric will work, although material with bumpy surfaces such as traditional watercolor paper or corduroy fabric proves difficult. Fabric should be stretched in an embroidery hoop or stapled to chip board or some other smooth surface. Artist Peter Madden (see Figure 1-1) makes transfers onto wood.

13 Vapor mask and gloves. Most solvents are dangerous, so a respirator and gloves should be worn.

Tips

■ The transferred image will appear as the reverse of the original; this is an especially important consideration when transferring type. You can solve this problem by photocopying the art onto acetate, flopping the acetate, and making a wrong-reading photocopy on paper. Or, use a computer to reverse the type, then photocopy the printout. When the wrong-reading image is transferred, it will look like the original art.

■ Since you are lifting the color layers from color printed material in the opposite order in which they were printed, colors may appear different in the transferred image. In general, select color pictures with bright highlights and deep shadows so the transfer retains separation of tones.

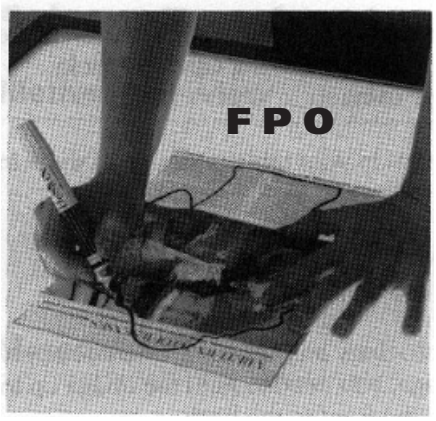
■ The blender pen, which seems to keep odors down, can be used if you transfer small (2 in. square or 5 cm square) areas at a time. Rub the marker on the back of the image, then quickly burnish. This method works best with color laser copies and computer laser prints, especially if you first copy the image onto acetate. My students have brushed Edwal Film Clear or Echo Movie Film Cleaner onto the back of color copies with excellent results.

■ Transparencies can be made by transferring onto the dull side of frosted acetate or drafting vellum.

■ Low-contrast images can be frustrating to transfer with clarity.

■ Older magazines or other publications may need more time and more transparent base for the solvent to penetrate and loosen the embedded ink.

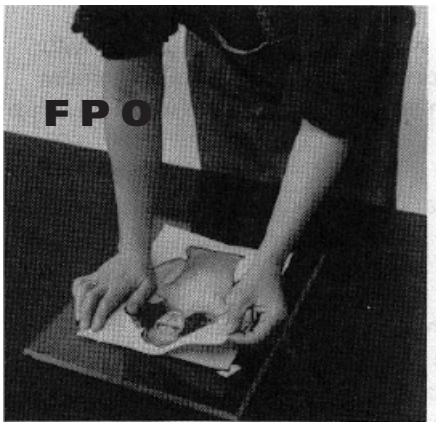
Making a Solvent Transfer



1

Preparing the image

Cut out the magazine picture or other image at least 1/4 in. (6.5 mm) larger than the image all around. Working at your light table or against a daylight window with the image facing away from you, use the black ink marker to draw, on the back side of the image, the outline of the area you want transferred.

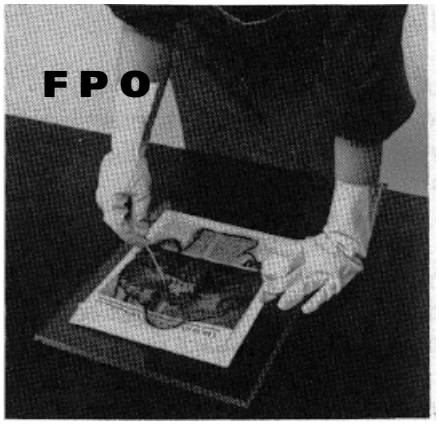


2

Making and attaching the cutout frame

Place the large piece of scrap paper on the back side of the image and retrace on it the image shape marked in step 1 above, using the light table or window to aid in the tracing. Cut out the shape marked on the scrap paper to create the cutout frame.

Place the image face up on your work surface. Adhere the masking or drafting tape onto the corners of the image's back side, with the sticky side of the tape facing you and the tape extending beyond the edge of the paper. Place the cutout frame over the image so that the frame lines up with the image, pressing the cutout frame to the tape. This frame will later prevent solvent from staining your receiver.



3

Applying the solvent

Place the receiver surface face up. Position the cutout frame and image face down, and tape this unit to the receiver. Evenly and lightly spray citrus solvent on the *back* of the image, or apply to the back of the image approximately 1/2 teaspoon (2.5 ml) of transparent base for a 5 × 7 in. (12.5 × 17.75 cm) image. Spread evenly and let the transparent base sit for a few minutes while it absorbs into the page to chemically loosen the ink. The paper will appear less opaque.

4

Transferring the image

Using the *edge* of the spoon, rub the back of the paper within the cutout frame window. To achieve a smooth transfer, rub in small circular strokes. To achieve a more drawinglike appearance, rub back and forth. Pick up one corner and check the transfer periodically, until the image has transferred completely to the receiver material.

Tips *(cont.)*

■ You can transfer onto a lithographic stone or plate. Use an acetic acid etch, and print normally. Since images transfer in reverse, type will print correctly for reading.

■ If you are using an etching or lithographic press, place the paper or cloth being used as the receiver *face up* on the bed of the press, and place the image *face down* over the paper or cloth. Apply the transparent base to the back of the image area and let it set a few minutes. Wipe off excess transparent base after it has absorbed into the paper—the paper will be more transparent so that you can see through to the print on the other side. Place blotter paper on the back of the image to protect the felts of the press from the solvents, and run the complete setup through the press using the correct maximum pressure. To make transfers onto cloth, mist the front of the magazine image with spot remover (such as Carbona) or the back with citrus solvent; you must work quickly because the spot remover evaporates.

■ Another method for transferring uses ink jet prints on Echo gum label paper, which comes in 25 × 20 in. white sheets (fifty-pound weight). If you have a large printer or want to cut the sheets down, they can easily pass through a computer color printer. Afterwards, you wet the *receiver* with a clean sponge, place the ink jet print face down on top, and rub with your hand or a brayer on the back or put the unit through a litho press. Using hard paper for the receiver helps retain the colors, and reversing the image on the computer ensures that the image will print correctly (facing the right way) after it is transferred.

■ After you transfer an image, let it air out in a well-ventilated area away from the space where you are working.

■ TheMagicTouch sells 8½ × 11 in. (size A4 in Europe) and 11 × 17 in. (size A3 in Europe) transfer sheets that work in color or black-and-white copiers to duplicate your image for heat transferring onto fabric, wood, metal, glass, or ceramic. (See the Supply Sources section in the back of this book.) To obtain more detail on cloth, spray the fabric with spray starch before transferring.

Polaroid Image Transfers

Starting with a slide or taking a "live" picture, Polaroid Polacolor™ color films can be used to quickly and simply create full-color photographic images directly onto artists' paper and fabric. By prematurely interrupting the instant developing process, you can force the color dyes to migrate onto your chosen substrate. You can also write or draw on the receiving surface before or after the transfer process, and transfer one image on top of another.

This procedure only works with the peel-apart Polaroid color films, not with instant films used with the 600 series One Step, Impulse, Cool Cam, and related cameras; the Time Zero film used with the SX-70 and Spectra cameras; nor with black-and-white Polaroid films.

Rick Hock (see Plate III) has exhibited large multiple-transfer prints internationally. Many commercial photographers also use this process.

Polaroid Image Transfers *(cont.)*

Safety

Read warning labels and wear protective gloves when working with all peel-apart Polaroid materials.

A sac containing an alkaline processing gel is discharged when the film is pulled through the film holder or camera rollers. This sac of gel, appearing along the edges of the film and in the discarded portion, is harmful to the skin, eyes, and mucous membranes. In case of contact, wipe it off immediately and quickly wash the area with lots of water. Ingestion injures the mouth and esophagus and can be fatal. Inhalation of gel dust after it has dried can cause lung problems. Be careful not to discard trash where children or pets can reach it.

Do not discard processing gel waste in the vicinity of acids.

The color photographic dyes found on the negative before and after the image is transferred are suspected carcinogens, so it is especially important to observe safety standards as noted earlier.

Upon request, Polaroid will send you a copy of *Polaroid and the Environment,* a brochure on post-consumer waste initiatives.

Method Overview

1 A receptor sheet is prepared.

2 A "live" situation is photographed or a projected slide is copied onto Polaroid peel-apart color film.

3 The film starts processing by being pulled through a film holder or the rollers of a special Polaroid camera.

4 The processing is interrupted and the *negative* is placed on the receptor and rubbed.

5 The negative is removed, revealing the photo image on the receptor.

Materials

1 Polaroid equipment. Several approaches to creating a Polaroid transfer exist. You can start with a slide and use a Vivitar or Polaroid Daylab Junior slide printer, which is about the same price as an inexpensive 35 mm camera. These two slide printers provide a $3\frac{3}{4} \times 4\frac{1}{4}$ in. (8.25 × 10.75 cm) image. Another choice is to project a slide or larger positive transparency (such as a "chrome," an office copy, or a drawing on acetate) via a color enlarger, a Daylab II/Polaroid slide printer, or a used (they are out of production) Polaprinter onto 8 × 10 in. (20.25 × 25.5 cm) Polaroid peel-apart film and run that sheet through a Polaroid 8 × 10 processor. I recommend the Daylab slide printer for all Polaroid film formats, including the more common $3\frac{1}{4} \times 4\frac{1}{4}$ in. film: it offers built-in color filters and cropping and enlarging features and can be used in regular daylight. Read the instructions packaged with the Daylab before you use it, including Polaroid's suggestions for color corrections with filters. In addition, the tips following this supply list explain ways to use color filters effectively.

You can also shoot live imagery, such as a still-life, portrait, or landscape. Use a large-format camera outfitted with a Polaroid back to yield 4 × 5 in.

(10 × 12.5 cm) or 8 × 10 in. (20.5 × 25.5 cm) images, depending on the camera. A 2¼ in. (5.75 cm) or 35 mm camera outfitted with a Pro Back (designed by Marty Forscher and available at good photography stores such as Gould Trading; see the Supply Sources section at the back of this book) or an N.P.C. back from Hunt's (also in Supply Sources) creates either one 2¼ in. picture or two pictures the size of a 35 mm positive (24 × 36 cm) on a sheet of Polaroid 3¼ × 4¼ in. (8.25 × 10.75 cm) film.

Alternatively, you can use an old Polaroid hand-held Land camera (sometimes found at yard sales and flea markets), the more expensive and difficult to find used 100 series Polaroid cameras, or the even more expensive Polaroid ProPack and 600SE cameras. A reliable source for both new and used Polaroid equipment is the Graphic Center (see Supply Sources), where you can purchase cameras, close-up lenses, and inexpensive Polaroid copy stands complete with a close-up lens.

Since colors shift during the transfer process and can be lost, you may try underexposing slides and live imagery by one-half to a full stop to achieve richer color saturation. Contrast increases with every generation of an image, and this is true with copying slides onto Polaroid film. One way to counter the problem is to use a low-contrast filter on your camera when you shoot the slide.

2 Polaroid peel-apart color film. You must use only Polaroid materials and only Polaroid Polacolor peel-apart films, not black-and-white or other color films. For a 3¼ × 4¼ in. image, use type 669. For a 4 × 5 in. format, use type 59 or 559, and for 8 × 10 in. pictures, use type 809. Polacolor 100 film has greater color saturation than the aforementioned films, but it has a yellowish tint that can only be corrected by using a blue filter on the slide printer and is far more temperamental. In addition, Polacolor 100 requires that the paper or other substrate be soaked in either extremely hot acidic water (approximately ½ cup of household white vinegar to 1 in. water if you use a 9 × 12 in. [22.75 × 30.5 cm] tray).

Polaroid packages an image transfer kit that includes a twin pack of type 669 film, 16 sheets of 5 × 7 in. (12.5 × 17.75 cm) watercolor paper, a 6 in. (15.25 cm) brayer, and a 9 × 12 in. (22.75 × 30.5 cm) tray. You can purchase it through the Polaroid office in your area—see Supply Sources for telephone numbers and addresses—or through a photography store.

3 Receiver. Transfers will work on almost any paper, depending on your technique. For instance, transfers can be made without presoaking the paper, which may be more difficult but allows you to use any type of paper, from thin napkins to foil board. If you use the presoak method described in this chapter, you will need a paper that does not easily delaminate, such as printmaking paper. Arches makes a heavy 140 lb. watercolor paper, which Polaroid packages in its transfer kits. Other papers that work well are Aquarelle watercolor (bright white), Curtis Paper Company's Tuscan Terra (light-weight, fibrous, and smooth), seamless studio backdrop (part rag content and available in many colors), frosted acetate, drafting vellum (wiped down with alcohol to make the colors adhere better), rice paper (softens and textures the image), and even wood veneer. Remember that smoother surfaces, such as hot-press paper, will retain more detail, whereas cold-press papers will create a rougher or more textured look. Transfers can be made onto fabrics, such as silk, where closer weaves retain more detail than, for instance, cotton. Polyester and acrylic fabrics tend to repel the Polaroid image. With both paper and fabric, dark colored surfaces are inclined to cover the image,

so light colors are preferable. See the section in Chapter 4 on supports for more details.

4 Water and tray. Transfers are best performed using water with a pH of 7 or higher (slightly alkaline). If you question the quality of your tap water, you can use distilled water. You need to fill a tray slightly larger than your paper with enough water to totally immerse the sheet for several minutes. The water should be hot (70–75°F or 21–24°C) to promote adhesion of the dyes to the receptor. Or, try a portable steamer to moisten the receptor sheet evenly.

5 Squeegee and board. Use either a clean darkroom squeegee, a windshield wiper, a blotter, or a paper towel to remove excess water from the receptor sheet. I have found that a reliably smooth surface under the paper, such as a piece of clean Plexiglas™ or Formica™, is helpful because it allows you to pick up the paper and drain the excess water into a tray or sink. Using this method you are also unlikely to rip the paper while you squeegee. If you are going to do a dry transfer, you will not need these two items.

6 Brayer (optional). To rub the negative evenly, some people use a soft rubber brayer such as the type found at art stores for linoleum printing. Others use a wad of paper towels, soft cloth, or a marble rolling pin from a kitchen supply store. (I use the side of my hand.) A plastic spoon helps transfer small, black image areas. Some of my students use a hair dryer on the back of the Polaroid material after they have rubbed it; then they press some more.

7 Scissors. Because of the chemicals contained in the film, it is safer to cut than to tear the negative from the Polaroid positive because cutting is less messy. I use a pencil to lightly mark where I want to place the image on the receiver.

8 Protective gloves. The process can be messy and the chemicals caustic, so use gloves. The more tightly the gloves fit your hands, the more easily you can work.

9 Utility knife (optional). Lifting the corner of the negative with a blade as you peel it off the substrate may prevent smudging and keep the bottom edge of the image clean.

10 Rubber cement, masking or drafting tape, and scrap paper. Before soaking the substrate, you can outline the image shape with rubber cement or tape to ensure clean image edges in the finished transfer. Pat masking tape onto your clothing to remove some of its stickiness before pressing it onto paper, because this way you are less likely to accidentally tear the paper when you lift off the tape later. Rubber cement can be lightly rubbed off the receiver after you transfer.

Before you begin the process, you can tape the damp receptor sheet down to a smooth flat surface to prevent it from sliding around and blurring when you make the transfer. If you are working on a slippery substrate, such as vellum or silk, also taping the negative down helps to prevent it from slipping while you rub.

Scrap paper has two purposes. First, you may want to eliminate part of the image by cutting a shape from scrap paper and lightly rubber cementing it down on the receiver before you transfer. Proceed as described in steps 2 through 5 and remove the scrap paper afterward, thus revealing the substrate itself where the scrap paper formerly was. Or, for more even results, rubbing on top of a sheet of scrap paper placed over the back of the negative as you make the transfer helps. After you rub the negative, you may want to weight it to the substrate with a brick upon the scrap paper.

11 Traditional marking materials (optional). You can embellish the transfer with color pencils, watercolors, pastels, dry pigment, and so forth. You may want to draw on the back of the negative with a ballpoint pen or cuticle stick to alter the transfer as it is developing.

12 Clock or watch with second hand.

Tips

■ Polaroid prints informative free brochures, such as *Advanced Image Transferring, Darkroom Techniques,* and *The Creative Uses Guide.* They also manufacture an instant black-and-white photo positive and special color film that is manipulatable, but not transferable, for their 600 series cameras.

■ By participating in the Polaroid Education Program, U.S. elementary school teachers can purchase Polaroid cameras and film at greatly reduced prices and obtain a brochure with curriculum ideas.

■ Transfers from live imagery, although more uncertain due to the one-of-a-kind nature of the process, allow for adjustments in composition, focus, lighting, and exposure, whereas the use of slides and transparencies makes creating an edition much easier.

■ You can double-expose in-camera or transfer one image on top of another. You can put two slides in the same mount, then overexpose, with the Daylab printers.

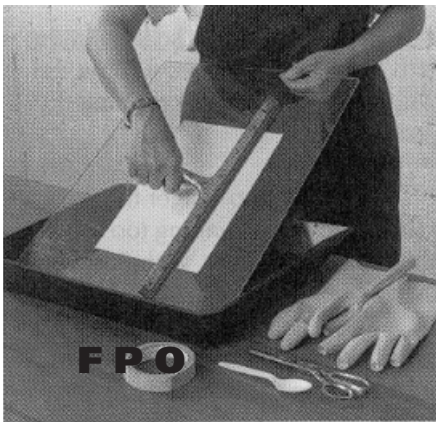
■ As the dyes from the negative migrate to the receptor, yellow transfers first, then magenta, and lastly cyan. Because the film is peeled off after the yellow has transferred to the Polaroid positive but before it has a chance to migrate to your chosen substrate, you can correct for the tendency toward magenta and cyan in the transferred image by using a 10 or 20 cc red filter with the initial exposure or copy of your slide.

■ With black-and-white transparencies projected onto color Polacolor film, you can use an amber filter for a sepia-toned transfer or a light blue filter for a monochrome.

■ Thin papers, such as rice paper and tissue paper, cannot be soaked in the tray of water. Instead, try placing the negative on the dry paper, turning the sandwich over and spraying the back with an atomizer, and then rubbing the negative to the paper.

■ I quickly cut excess Polaroid packaging from around the picture before peeling the negative from the positive.

Making a Polaroid Transfer



1

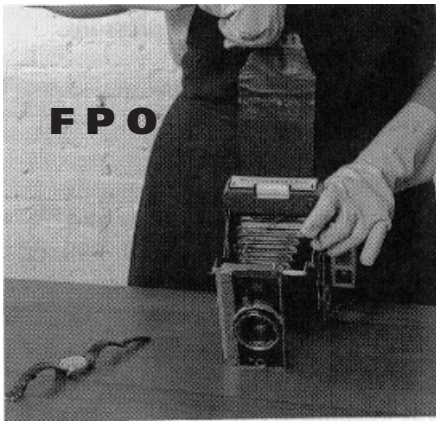
Preparing the substrate

In a tray larger than the receiver, thoroughly soak the paper in 75°F (24°C) water for at least 30 seconds. Completely squeegee off excess water.

2

Creating the image

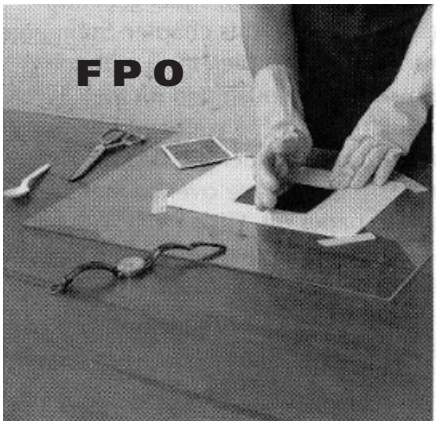
Either place your slide in the slide printer loaded with Polacolor peel-apart film and make an exposure, or shoot the scene with your Polaroid-backed camera. Then pull the white numbered tab, revealing the flap of the film.



3

Starting the processing

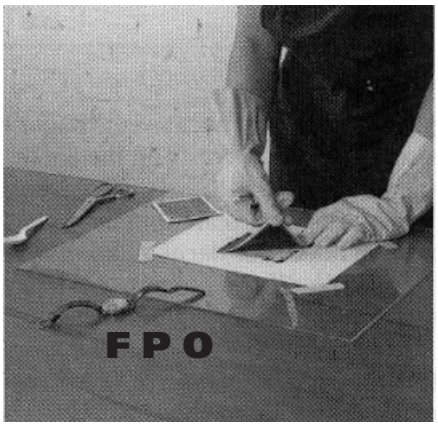
Put on protective gloves. Holding the flap securely, pull the film through the rollers in one smooth motion. Wait no more than *10 seconds,* then either cut or pull the negative away from the Polaroid positive. Quickly place the negative (which has a black backing) face down onto the receptor.



4

Applying pressure

Apply pressure for 30 seconds to the back of the negative with the side of your hand or a brayer. Make sure that you rub the entire back, concentrating more on the rear of dark image areas. Do not rub beyond the image area or the chemicals will seep out onto your hand or the brayer. Let the sandwich sit, usually for a total of 90 seconds to 2 minutes. A hair dryer's heat on the back of the photo may aid in the migration of the dyes. You will have to experiment with different pressures, sitting times, and receptors.



5

Peeling the negative

Put your fingers on the Polaroid as you *roll* back the negative, starting at one corner and *slowly* peeling on a diagonal. If part of the image starts to lift off, rub the image back in that area and try rolling the negative off again. You have a transfer when you have removed the negative completely!

6

Finishing the transfer

Before the paper completely dries, color can be lifted from the image with a blade. Excess chemicals along the image's edges can be removed with a foam brush or a paper towel. You may want to flatten the transfer print in a dry mount press or under a hot iron, but make sure the print is protected with a clean sheet of scrap paper. After the print dries, you can erase part of the image with very fine-grain sandpaper.

Tips *(cont.)*

■ Some artists wait a little longer than 10 seconds, but no longer than 30 seconds, before peeling the negative from the positive. By waiting too long, one runs the risk of ending up with a spotted blue cast. However, with Polacolor 100 film, wait 2 minutes.

■ Once the negative is separated from the Polaroid positive, place it face down on your receptor sheet as quickly as possible because the dyes may dry and not transfer, or ambient light may distort the colors.

■ When rubbing the back of the negative, do not go beyond the image area or the gel will ooze out onto your brayer or hand. Uneven pressure can cause blotching, whereas too much pressure prevents good adhesion to the substrate.

■ If certain areas of the transfer seem to be lifting off as you remove the negative slowly from the substrate, stop peeling and try rerolling that area. With heavier paper, you may find that if you allow the negative to sit on the receiver too long it becomes difficult to peel off.

■ Make sure you clean the camera rollers and film exit slot regularly with a lint-free cloth and room-temperature water because dirt can cause scratch lines on the image, and old chemicals can create brown stains.

Tips *(cont.)*

■ Transfers onto fabric may require more presoaking and more pressure.

■ Record your procedures as you work so you can determine the effects of different variables. The direction of the grain of the paper, for instance, can affect the transfer.

■ You can get a second transfer from the same negative, even much later after you performed the first transfer, by placing it on wet paper and running this unit through a litho or etching press.

■ Polaroid 20 x 24 in. (51.25 cm x 61.5 cm) transfers can be made with a special camera. Call Polaroid or check mammothcamera.com.

Polaroid Emulsion Lifts

An *emulsion lift,* in which you peel off the actual image layer and adhere it to your substrate, can be made with Polaroid type 669, 59, 559, or 809 film.

Expose and process a sheet of film as you would normally. Let the photo dry *completely* overnight, or dry it with a hair dryer. Then reinforce the back with plastic contact paper or spray paint. Let this backing dry while you prepare one tray of very hot (110°F or 43°C) water and a second *ridgeless* tray of cold water.

Dampen, squeegee, and adhere the receiver, such as artist's paper, to a smooth surface as described in step 1 of Making a Polaroid Transfer.

Submerge the photo face up in the hot water until you see the emulsion start to bubble, which is usually 4 minutes. If the water cools and the bubbling has not started, add more hot water.

Pick up the photo with tongs and place it in the cold water. Wearing gloves, gently press the print, image side up, to the bottom of the tray. With your other hand, push and lift the emulsion from the edges of the print so that it floats in the water. If the emulsion rolls up on itself, roll it flat against the Polaroid backing. Once the emulsion is free and flat, discard the paper backing.

Optional: In order for the finished piece to read correctly, slip a piece of wax paper under the floating image and maneuver the image onto it. Flip the wax paper and image over so that the image is face down in the water. Strip the wax paper off. Slide fresh wax paper under the emulsion again, and then stretch the image to remove wrinkles.

Carefully turn the wax paper with image, image side down, onto your paper or substrate. Gently rub and straighten the image, remove the wax paper, then carefully roll the emulsion with your fingers or with a clean, soft rubber brayer from the middle outward, assuring the even adhesion of the emulsion to your chosen substrate. If the image is resisting adhering smoothly, remove the emulsion from the wax paper in the cool water tray, plunge the receiver under it, then lift the paper up and underneath the emulsion.

Magazine Lifts

A *magazine lift* provides another simple, versatile method of removing a printed image from its page. Lifts are made by adhering either tape or acrylic (poly-

mer) medium to a printed image to separate the ink embedded in the coating of the paper from the mass of the paper. The lift can be employed as a transparent page in a book, mounted in a slide holder and projected, stuffed and stitched, or warmed and sculpted. Another application is to enlarge or contact print a lift in a darkroom onto orthochromatic film (see Chapter 5) to make a negative. Lifts can be used as the transparent halftone positive for photo silkscreen or as a decal to be adhered to surfaces such as fabric, acetate, paper, wood, glass, and ceramic.

Safety

No special precautions need be taken with materials used for making magazine lifts.

Method Overview

1 Printed image is selected and prepared.

2 Transparent tape, clear contact paper, or acrylic medium is applied to the front of the image.

3 When dry, the taped or coated image is then soaked in water until the paper dissolves, separating the inked image from the paper.

Materials

1 Image. The inside pages of glossy magazines work best because the paper is coated with clay (kaolin), which is water soluble. The ink rests on the kaolin, not the paper. Front and back covers do not work well because they are usually varnished, and this seals in the ink. Newspaper pages are thinner, and often the images on both sides of the paper get lifted. For decal technique, color images from high-quality magazines are the most reliable. Choose slightly contrasty images with bright, detailed highlights and clear shadows to retain tonal separation.

2 Heavy transparent tape, clear contact paper, or clear acrylic polymer medium. These are the *adherents* used in the different lift methods. Transparent tape for winterizing windows or tape for mail room use (also known as packing tape) usually is available in hardware stores and is effective for smaller pictures. Clear contact paper used for lining shelves works with large pictures. Clear acrylic polymer medium (Hyplar™, Aquatex™, Liquitex™, etc.) is sold at art stores and provides the best flexibility in the final lift. Immediately after using the polymer medium, you must wash brushes with soap and water or the bristles will harden.

3 Metal spoon, burnisher, etching press, or paintbrush. These are the *applicators* used in the various lift methods to assure adhesion of the magazine page to tape or contact paper, or, in the case of the paintbrush, to apply the polymer medium. A 1½ in. (4 cm) width soft brush is recommended.

4 Brayer. A brayer is a printer's ink roller, usually used for linoleum printing but also practical for the polymer lift method when transferring onto fabric or acetate. Brayers can be purchased at art stores or hobby shops. Inexpensive substitutes include a kitchen rolling pin or a straight wine bottle rolled on its side.

Magazine Lifts *(cont.)*

5 Tub, sink, or dish pan and water.

6 Scissors.

7 Soft cloth. A clean, pressed piece of cloth is needed if you want to lift onto fabric, and another piece of cloth is necessary for blotting the fabric.

8 Blotter. For fabric lifts, a blotter the size of the fabric is needed.

9 Sheet of glass larger than the image.

10 Receiver. Almost any paper or fabric or surface will work. Fabric, if used, should have medium weight and fine woven texture for best results. Natural fibers and natural-synthetic blends work better than synthetics. When applied to clear acetate, lifts can be layered, stitched, stuffed, and heat-sealed to each other for inflation into sculpture.

11 Hair dryer. A hair dryer hastens drying time for polymer lifts and softens the polymer for sculpting decals.

12 White paper and acetate. For lifts onto clear acetate, you need a large piece of white paper, such as shelving paper.

Tips

■ The acrylic medium method works best if you do not brush on a thick coating; otherwise, the medium will penetrate too deeply into the paper fibers, making delamination difficult. Rubbing or scrubbing the image as you apply the medium can smear the ink.

■ Acrylic lifts can be used like decals. Make sure that the surface on which you want to place the decal is clean and dry. Then coat the surface with an even layer of polymer medium. Smooth the lift made by the acrylic (polymer) medium method onto the surface with the image right side up. Hold in place for several minutes. Remove excess medium with a moist cloth.

■ To apply an acrylic medium lift to curved surfaces, gently heat the lift with a hair dryer until it becomes pliable, then apply the decal lift to a correctly prepared surface.

■ When using acrylic polymer medium, be sure to immediately wipe excess medium off your work surfaces or receiver surfaces using warm water and a sponge.

■ To brighten the image after the fabric has dried, apply an 80% watered-down coating of the medium to the image transfer area only.

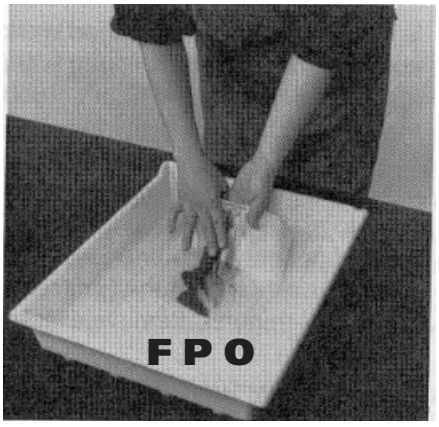
■ Acrylic lifts are sensitive to heat and cold. They will soften when warmed and become brittle when chilled, even if left outside on a cold day.

Making a Lift — Tape Method

1

Cutting and adhering the image

Cut out the magazine drawing, photograph, graphic, or type slightly larger than the image area. Press the sticky side of the tape or contact paper onto the image. Thoroughly rub the back side of the image with a spoon or burnisher, or put this sandwich construction through an etching press.



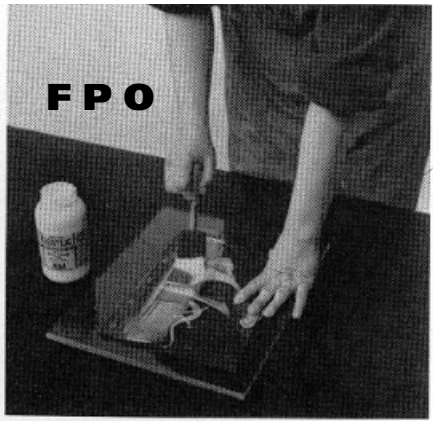
2

Soaking and drying the image

Float the taped or contact-papered image face up in warm water for 15 minutes. The paper will start to delaminate. Gently rub the back of the paper, removing the paper fibers but leaving the picture's ink stuck to the tape or contact paper.

Remove from water. Weight down the lift by the corners until the piece dries, then trim as desired with scissors.

Making a Lift — Acrylic Medium Method



1

Preparing and coating the image

Cut out the image to be lifted, trimming off all extraneous areas. Place the image face up on a sheet of glass.

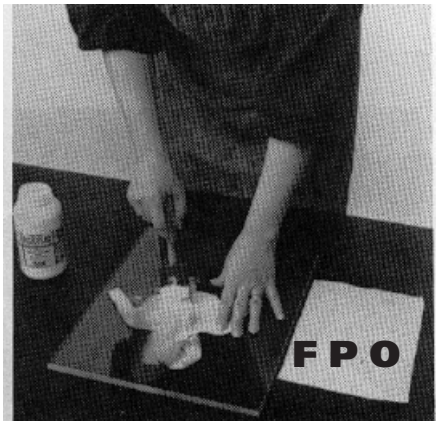
Apply a thin, even layer of acrylic medium by brushing with strokes going in the same direction. Air dry or blow dry, and coat again at a 90° angle to the first brushing. Dry again and coat again, repeating for a total of six to eight layers, alternating the direction of the brush strokes and drying thoroughly after each coating.

2

Soaking and drying the image
(See illustration for Tape Method, step 2.)

Float the acrylic-coated image face up in warm water and soak it for 15 minutes. The paper will become soft and start to delaminate. Gently rub the back of the paper to remove the paper fibers, leaving the inked image adhered to the acrylic medium. Air dry or blow dry, if heat is needed to make the lift pliable.

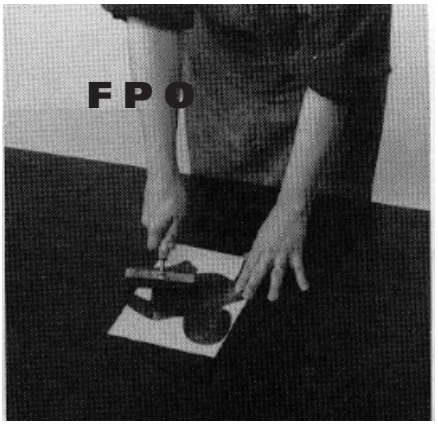
Just by making simple alterations in the lift process, you can transfer images to fabric. Note that these transfers will have the image reversed, whereas the methods described previously produce images that read correctly. Lifts transferred to fabrics will be pliable in addition to being reversed.



1

Preparing the fabric and the image

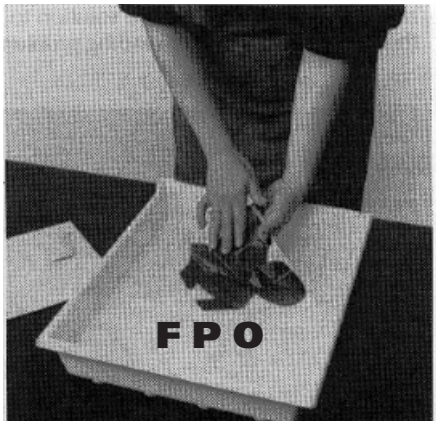
Place a clean, pressed piece of fabric on a flat, hard surface. Select your image and trim all excess before placing it *face up* on a sheet of glass. Brush on an even, heavy coat of acrylic medium and wait about 30 seconds. The paper of the image will curl and look semitransparent, indicating that the medium has penetrated through the paper.



2

Combining the image and the fabric

Carefully set the wet, coated image face down on the fabric. Roll a brayer over the back of the image, pressing the fabric and picture tightly together, making sure to remove wrinkles. Turn the entire piece—image and fabric—over, and roll the brayer across the fabric. Test the image piece to see if it has adhered to the fabric by picking up the edges. If the image does not cling, remove the entire piece and recoat as in step 1, and reaffix the image piece to the fabric as described above in this step.



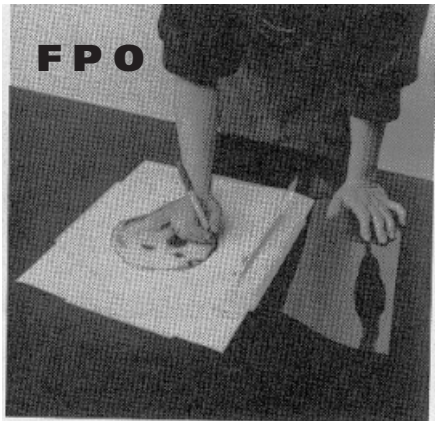
3

Removing the paper backing and drying

Let the united fabric and image piece dry thoroughly, preferably overnight; then place the unit in a tub of warm water. After soaking for several minutes, the paper backing should peel away from the image with gentle rubbing. Remove the fabric from the water and lay it on a blotter, image side up. Gently wipe the image with a damp cloth to remove any pieces of paper that may remain. Hang the fabric to dry, and *do not wring.*

If any part of the image peels or pulls from the fabric along with the paper backing, resubmerge the whole unit and begin peeling from the center to avoid damaging the edges. Once the fabric has dried, use polymer medium to reglue the loose areas of the transfer.

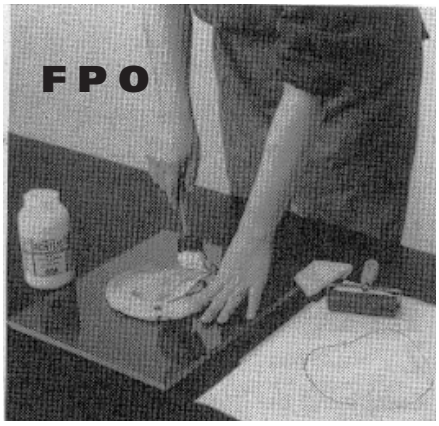
Images can be transferred onto acetate sheets, which are available at art stores. Like the method for lifts on fabric, this technique uses the acrylic polymer medium to lift images from printed material for transfer onto a second receiver. In addition to providing a more rigid base, the transparency of the acetate together with the transparency of the dried polymer medium offers an alternative solution to the right-reading/reverse-reading problem.



1

Preparing the image

Cover a flat work surface with a large white piece of paper, such as shelving paper, drawing paper, or typing paper, and secure this sheet to the work surface. Place the trimmed image page face up on the paper and carefully set a clean sheet of acetate over the image. Tape one edge of the acetate sheet to the white paper, creating a hinge, and then lift the acetate back open. Mark the outline of the image piece on the white sheet of paper.

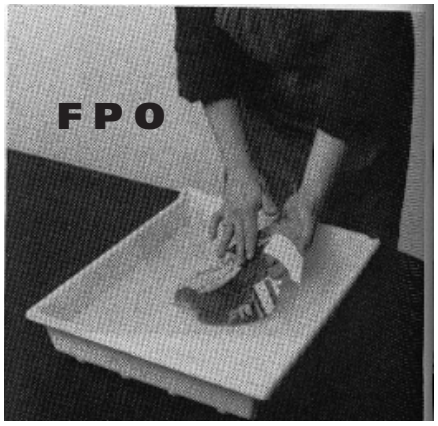


2

Coating the image

Place the image face up on a sheet of glass, and apply an even coat of acrylic polymer medium. Return the picture, coated side up, to the outlined position on the white sheet of paper. Lower the acetate sheet and smooth it over onto the image piece. Untape the acetate sheet and turn it and the adhering picture over in order to roll the brayer across the back of the image. Lay the acetate-image unit on a flat surface, acetate side down, and wipe off any excess medium from the acetate with a damp cloth.

Allow this unit to dry thoroughly, until the medium turns transparent.



3

Removing the paper backing

Place the acetate-image unit in a tray of warm water, paper side down. Soak for several minutes until the paper backing to the image piece is soft, then turn the unit over; gently rub the paper from the acrylic coating the acetate.

Blot gently and allow the acetate sheet with the image adhered to it to dry.

Chapter 2 HAND COLORING

Hand coloring is a means by which you can add color to a photograph or photographic print to expand the visual and psychological impact. Those who do not feel comfortable drawing but feel the need for painterly expression may find satisfaction in hand coloring a photograph; modeling, perspective, and anatomy are already apparent in the photo.

Before color photography became widely available and relatively inexpensive, studio photographers hired artists to apply transparent layers of thinned oil paints or water-based aniline dyes to black-and-white portrait photographs. Multiple layers of color were built up as the artist allowed each coating of paint or dye to dry and harden before adding another layer. Many advertising firms today use hand-colored touch-ups of color photographs to infuse objects with more vibrant color than they originally possessed. Colorists are also sometimes hired to paint color into black-and-white photographic murals.

One need not have a darkroom; hand coloring should be done in indirect daylight or under fluorescent or blue-frosted daylight bulbs.

The two major categories of materials for hand coloring are water-based materials (toners, dyes, and watercolors) and oil-based materials (oil paints and special photo oils), which may be used alone or in combination with each other. If you combine the two methods, it is advisable to apply water-based colors first because oil-based materials will adhere to water-based ones, whereas water-based materials do not apply well over oil.

Selection of the coloring agent depends on whether you wish to apply color to a glossy photograph (water-based materials work more easily) or to a matte photograph (either oil or water-based colors can be used), and on the effect you wish to achieve (water-based colors seep into the gelatin coating of a photograph or the image area of a print, allowing the detail of the photograph and texture of the paper to show; oil paints rest on the surface of the picture and, if applied thickly, can cover up photographic detail and the texture of the paper). Both oil-based and water-based colors can be applied to selective areas or the entire image, on paper as well as fabric.

Water-Based Method

Water-based materials come in a wide variety of colors and types, and they work well on many surfaces. Once you feel comfortable with the suggested procedure for water-based coloring, don't be afraid to experiment. Many exciting results come from techniques that are not supposed to work.

Safety

Certain colors—such as emerald green, cobalt violet, true Naples yellow, all cadmium pigments, flake white, chrome yellow, manganese blue and violet, burnt umber, raw umber, Mars brown, lamp black, and vermilion—can lead to poisoning and other complications if they are ingested or inhaled frequently. Wearing a ventilating mask and protective hand cream, working in a ventilated area, and carefully washing your hands with soap and water—not solvents—and cleaning your fingernails after using these pigments can help prevent accidental poisoning or ingestion of the colors. Never point the tip of a brush by putting it in your mouth.

Wear goggles and protective gloves to avoid eye contact with wetting agents and other chemicals.

Never smoke or eat while you are painting.

Method Overview

1 Photograph or photographic print is prepared.

2 In daylight or a mixture of fluorescent and incandescent light, colors are applied to build up areas or layers.

3 Print is fixed to protect colors, or print is allowed to dry.

Materials

1 Image. Black-and-white, toned, or color photographs are fine. Almost any fiber-based photo paper works well with water-based materials. In addition, Kodak's P-Max Art and Luminos' RCR-Art papers are resin-coated papers that are intended for hand coloring. Photographic prints on artists' paper will take water-based colors, but both types of pictures (i.e., on photo paper or on artists' paper) must be flattened or a crack or crease will show up as a dark streak when you color the picture. Natural or natural-synthetic fabrics will accept water-based colorants more easily if they are ironed or stretched on canvas stretchers first, although most water-based paints fade when the fabric is washed.

2 Water-based colors include Marshall's Retouch Colors, Kodak Retouching Colors, Luminos' Retouching Kit (including their wetting agent to ease application), Veronica Cass Liquid Colors, Nicholson's Peerless Transparent Water Colors, PEBEO liquid toners, Jobo Photo Color Dyes, artists' watercolors and acrylics in tubes, food coloring, and felt-tip pens. I have found Dr. Martin's Synchromatic Transparent Colors to be the most intense colors. Marshall's and Kodak's retouch colors and Dr. Martin's and Veronica Cass's colors come in bottles of concentrated dyes and can be purchased at photography stores. They can be diluted with water before use.

Peerless Watercolors, available at art stores, are made for application on black-and-white photographic paper and are great to travel with because they are packaged as booklets of color-saturated sheets. They can be wetted with a brush for application directly onto the image, or a piece of the sheet can be cut off, placed in a bowl, and covered with just enough water to dissolve the color from the sheet. Excess color can be blotted off with the blotter supplied in the booklet or removed entirely by immersing the print face down in a pan of water.

Water-Based Method *(cont.)*

Food coloring found in grocery stores (the least expensive coloring agent) or tubes of watercolor paints from art stores can be applied to photos if a wetting agent such as Kodak's Photo-Flo or Ox Gall, purchased at an art store, is added to either of them before use. Food coloring, however, is difficult to remove from a print after it has been applied. Ralph Hattersley suggests using medicinal dyes, such as merthiolate (shocking pink) and gentian violet (purple) to extend the limited range of food colors (*Photographic Printing,* p. 221). See the tips on page 37 of Chapter 3 for more ideas concerning medicinal and food dyes.

On black-and-white photos, I have taken to drawing with color spotting pens, which are intended for getting rid of problems in color photos. Alcohol-based permanent markers can add a wet-on-wet color quality to glossy photographs and laser color copies, and nonpermanent felt-tip pens are great for tiny areas.

Photographic prints on sized or unsized artists' papers and fabric images made by the techniques described in this book take to water-based materials in varying degrees. Artists' quality watercolor paints and water-based felt pens work well, as do retouch colors and Peerless colors, colored pencils, crayons, and pastels. For fabric, Binney and Smith makes Crayola Craft™ fabric crayons, and Pentel makes Fabricfun™ pastel dye sticks. Pebeo manufactures Setacolors, described in Supply Sources under "Fabric Suppliers." Perusing the aisles of a craft store will offer imaginative possibilities for adding color to fabric and rag paper.

3 Toothpicks, cotton swabs, cotton balls, sable watercolor brushes, or cosmetic sponge. By wrapping a thin piece of absorbent cotton around a toothpick or skewer (available in butcher shops and barbeque suppliers), you can make an inexpensive, disposable tool for coloring details. A damp sponge or cotton ball lightly wiped over the surface of a photograph facilitates the application of colors to large areas.

4 Kodak Photo-Flo or an equivalent wetting agent can be purchased from a photography store (wetting agents are usually used when developing film).

5 Water. You do not need running water, but you will need a 32 oz (946 ml) tray of water at room temperature. You may need a beaker to dilute the wetting agent with water.

6 Household bleach or household ammonia can be diluted with water, picked up on a cotton swab, and gently rubbed on undesirable color for partial removal of that color. Too much rubbing, however, will lift off the emulsion or image.

7 Masking tape is needed to secure the print to your work surface. Make the tape less sticky and less likely to damage your print by patting a length of it onto your clothes before using it. When you are finished coloring, you can remove the tape easily, leaving the print with clean borders. For prints on artists' paper, drafting tape is less sticky and will not rip artwork when removed.

8 Newspaper or glass protects a tabletop from stains caused by the dyes. Make sure that your work surface is smooth, because indentations show up as imperfections in the colored area of the image.

9 Facial tissues such as Scott Precision Wipes can blot liquid color and wipe the brush of excess color. Protective silicon hand cream from a hardware store is needed if you plan to apply color without wearing gloves.

10 Medicine dropper, available at drugstores, controls the dilution of mixed solutions. A measuring cup is needed for mixing the solution.

11 Bowls or paper cups. Use small white bowls or paper cups to hold diluted colors. A white ice cube tray also makes an efficient palette.

Tips

■ As with numerous processes in art, beginners will avoid some frustrations if they start small, get used to the procedure, and then work on larger images if desired. I recommend that you start with an 8 × 10 in. (20.5 cm × 25.5 cm) photo that does not contain many small details. If you cannot afford the lamps with fluorescent and incandescent bulbs, set up near a window so that you work with a combination of indirect sunlight and a desk lamp.

■ Highlights, shadows, and modeling in the photographic print can show through the layers of paint. Start with a color lighter than you want, and slowly build up layers until the desired chroma is achieved.

■ Almost any brand of artists' colored pencils, crayons, and pastels can be used on photographs if you prepare the surface beforehand with a layer of workable fixative, such as McDonald's Protectacoat Retouching Lacquer (see Porter's Camera Store in the Supply Sources section) or Grumbacher's or Marshall's Pre-Color Spray, available at art stores. All of these sprays are toxic and flammable, so treat photos outdoors or in a strongly ventilated area. After applying pencil color to the print surface, you can rub it in with a cotton ball or swab.

■ Kodak manufactures double-weight black-and-white polyfiber photo paper in rolls, which is processed in conventional darkroom chemicals. After the image is dry it can be torn, toned (see Chapter 3), or drawn on with colored pencils and other media. Kodak stopped making mural paper in 1987.

1

Securing the image

Press 2 in. (5 cm) of masking or drafting tape to the work surface. Continue pressing half the tape flush to the border of the image, and half the tape to the work surface, with 2 in. extending beyond the print. Tape down all sides of the print in this fashion.

2

Preparing the toothpicks

(See illustration in step 2 of the Oil Painting Method, page 28.)

Fray the edges of a ½ × ½ in. (1.25 × 1.25 cm) piece of cotton. Moisten the tip of a toothpick in water, and place it in the center of the cotton. Fold the cotton over the tip and wind the cotton tightly up the shaft, away from the point. Make at least six toothpicks, skewers, or sandwich toothpicks.

3

Preparing the palette

Squirt one drop of each color or squeeze a pea-sized amount of pigment into separate bowls or cups, or mix different colors in the same cup to create new hues.

Using a medicine dropper and a measuring cup, mix one drop of Photo-Flo to 4 oz (114 ml) of water. Add drops of this diluted wetting agent to each bowl of color until you make the color a shade lighter than you want on the print. Mix thoroughly.

4

Applying color

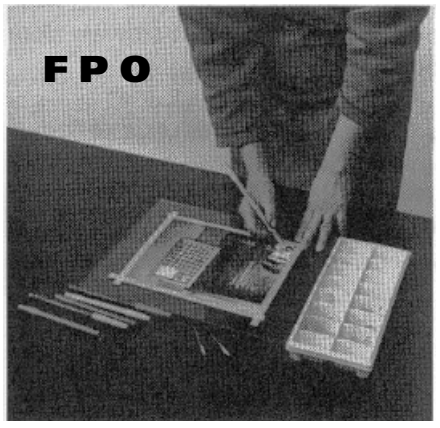
Dip a clean cotton ball or sponge in the diluted wetting agent, and lightly wipe the photograph or print.

Saturate another cotton ball with the wetting agent-color mixture; then apply the color lightly to a large area (such as the background) by quickly stroking the image with the color. If the hue is too light, resaturate the cotton ball and reapply the wetting agent and color to the picture.

5

Removing color (optional)

In a cup, mix one drop of bleach to ten drops of water. Saturate a cotton swab with this mixture, and lightly rub an area of unwanted color with the swab. Blot the area dry with tissues or blotter paper.



6

Adding new colors

Dip a fresh cotton swab into another bowl of color, and stroke the swab in a new area of the image. Remove unwanted color as in step 5. A cotton-wrapped toothpick, pointed sable brush with less color, or a felt-tip pen works in small areas. Clean brushes after each use.

7

Finishing the print

Air dry the colored print overnight. If you want to work further on the print, you can use more water-based color or oil-based pigments.

Carefully remove the masking tape after you have completed coloring.

Oil-Based Method

Oil-based hand-coloring materials are easier to control and apply than water-based ones. Mistakes made with oil paints and photo oils can be removed easily, and prints can be reworked, yet oil-based paints have the greatest permanence of all hand-coloring materials.

Safety

Turpentine (found in Marshall's Photo Oils Prepared Medium Solution) can cause skin and respiratory irritation, allergic reaction, and kidney damage, sometimes years after exposure. It is highly poisonous if ingested and should be stored out of children's reach. Wear a ventilating mask and protective gloves and work in a well-ventilated area.

Certain pigments—such as emerald green, cobalt violet, true Naples yellow, all cadmium pigments, flake white, chrome yellow, manganese blue and violet, Verona brown or burnt umber, raw umber, Mars brown, lamp black, and vermilion—can lead to poisoning and physical harm if they are ingested or inhaled frequently. Try to substitute other, less harmful pigments, wear a ventilating mask, and work in a ventilated area. Carefully washing your hands and cleaning your fingernails after using these colors can help prevent accidental poisoning or ingestion of the colors.

Never smoke or eat while painting, and do not allow any painting materials to come into contact with your face.

Marshall's Pre-Color Spray and other primers are toxic and highly flammable, so do not use them near an open flame or throw the empty can into a fire. Spray outdoors or in a very well-ventilated room while you wear a mask.

Trichlorethylene, found in Marshall's Marlene, is a suspected cancer-producing agent. It is highly toxic by inhalation and ingestion, causing possible nervous system disorders and reproductive system problems. I strongly urge you not to use it, but if you must, be sure to wear protective gloves and a vapor mask and work in a well-ventilated area (i.e., one that has 20 changes of air per hour). In the presence of flames—even lighted cigarettes—and ultraviolet light, trichlorethylene can decompose into a toxic gas. It is flammable if heated.

Method Overview

See page 21 for overview.

Materials

1 Image. Black-and-white, toned, or color photographs work fine. Luminos makes RCR-Art (graded) and Kodak makes P-Max Art RC (graded) warm black paper specifically for hand coloring. Other usable matte resin-coated papers include Ilford Multigrade and Agfa Portriga Speed. Fiber-based matte papers, such as Ilford Multigrade and Kodak N and E surface, absorb oils very easily and are believed to be more archival, but the blacks tend to be more subdued. Other suitable matte fiber papers include Ilfobrom Galerie, Kodak Ektalure, Luminos Charcoal, and Luminos Tapestry.

Photographs should be dry and flat because a crack in a print will show up as a dark streak of color. Work from a technically good and slightly light photograph—it is difficult to conceal a muddy image. Some photographers prefer first toning the photo (see Chapter 3) before hand coloring so they can change the blacks and even the paper base. Other variables to consider include the contrast, or amount of black, white, and gray; the image tone (whether it is a

warm brown-black, a cool blue-black tone, or a neutral green-black tone); and the base of the photo paper itself, which can be bright white or off-white. You might find it less frustrating and less expensive to start with an 8 × 10 in. (20.5 cm × 25.5 cm) image with simple shapes and work up to larger, more complicated pictures.

Artists' paper, on which one can create photographic prints by the methods described later in this book, must be flattened and may be primed with Marshall's Pre-Color Spray to avoid stains from the paints. Fabrics such as linen and other natural fibers accept oil-based colorants and work best if first ironed or pulled over canvas stretchers.

2 Oil-based colors. Paints made especially for application onto photographs include Marshall's Photo Oil Colors. (For saturated hues, see Brandess/Kalt and Marshall's Extra Strong Colors in the Supply Sources section.) Marshall's also manufactures Photo Oil Pencils, great for coloring small details, and extender, which has a variety of uses. The addition of extender to Marshall's oil colors creates more subtle hues, helps move color across the photo's surface, and works well for cleaning paint away from small areas. The extender or Grumbacher's Transparentizing Gel, often a special-order item in art stores, can be mixed with traditional artists' oil paints for easier application onto photos or for making a color sheerer so that the highlight detail, shadow, and modeling of the photograph show through the layer of color. Marshall's Introductory Kit does not include extender, but you can buy a separate tube. The photograph can act like a painter's underpainting, and the layers of color can act like a painter's glazes. Allow one layer of color to dry before adding another.

3 Cotton balls and cotton swabs. Cotton balls or absorbent cotton apply color in large areas of the picture, whereas swabs such as Q-Tips blend the edges of areas of different colors. Both products are available in drugstores.

4 Toothpicks, bamboo or metal skewers, sandwich toothpicks, and pointed red sable brushes. By wrapping a thin piece of absorbent cotton around a toothpick or a wooden hibachi skewer (available in butcher shops), you can make an inexpensive, disposable tool for coloring details and removing unwanted paint from small areas. Because the hibachi skewer is long, it is great for reaching the bottom of an almost-empty bottle.

5 Palette. A sheet of glass underlined with white paper or a white china plate best displays true colors, and you can mix colors on such a palette. The disposable paper palettes available in art stores also work well. Wax paper is not advisable, because the wax can chip into the paint.

6 Surface preparation. Rectified turpentine (sold at art stores) or Marshall's Prepared Medium Solution is wiped over the surface of an uncolored photograph to make the colors spread more easily. In addition, either of these solvents saturated onto a cotton swab can be used to soften the tips of colored pencils for a less streaky effect.

Grumbacher's or Marshall's Pre-Color Spray or McDonald's Protectacoat Retouching Lacquer (see Porter's Camera Store in the Supply Sources section)

dulls glossy photos and thus makes the image surface easier to work on. Marshall's recommends using Marlene to remove unwanted paint, but Marlene will also strip these primers off the photo. Use a kneaded eraser instead.

You do not have to prepare photographic prints on traditional artists' paper unless the paper grips colors too much for you to control. Marshall's Pre-Color Spray helps avoid stains from the paints.

7 Kneaded eraser or Marshall's Prepared Medium Solution can remove small areas of unwanted color—this must be done before the paint dries and hardens. Kneaded erasers, such as Faber Castell Peel-Off Magic Rub nonabrasive erasers, are sold at art stores and are made of malleable rubber that can be worked to a fine point. Eraser particles can be dusted off with canned air.

8 Fixative or McDonald's Protectacoat Sealer (optional) can be used to protect the surface after an image has been painted and dried. Fixatives are sold in art stores, but they are not of archival quality because they can yellow a print within a few years. Spray fixatives are very toxic if inhaled, and a ventilating mask should be worn when you use them.

9 Facial tissues without additives such as aloe or oil. Because of health risks (see Safety section, page 25), color should be smoothed on with a finger covered with a tissue, such as Scott Precision wipes, or a soft piece of cloth, such as an old handkerchief. Protective silicon hand cream from a hardware store is needed if you plan to rub color in with your bare fingers.

10 Masking tape is needed to secure the print to your work surface. Before adhering tape, make it less sticky and less likely to damage your print by patting a length onto your clothes. When you are finished coloring, you can remove the tape easily, leaving the print with clean borders. For prints on artists' paper, drafting tape, which is less sticky, is advised because it will not rip your artwork when removed.

Badger's Foto Frisket Film can keep the borders white as well as temporarily seal a color when you apply another color near it. The film comes in a roll that is cut with a sharp blade in daylight.

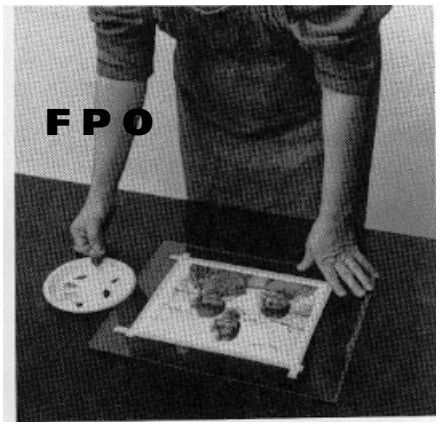
11 Newspaper or glass protects a tabletop from stains caused by turpentine and oils. Make sure that your work surface is smooth, because indentations will show up as imperfections in the colored area of the image.

12 Spot Tone, retouch colors, or spotting pens, available at photography stores, eliminate white marks on the photo, often caused by dust on the negative when it is being printed. Follow the manufacturer's instructions.

Tips

■ See tips for water-based materials, page 23.

■ Highlights, shadows, and modeling in the photographic print can show through the layers of paint. Start with a color paler than what you want and slowly build up layers until the desired chroma is reached. Once a color has dried onto the photograph, never use Prepared Medium Solution or turpentine to work more color into that area—these preparations can loosen the underpainting.



1

Setting up

Press a length of masking or drafting tape half to the work surface and half along the border of the image and beyond the print. Tape down all sides of the print in this fashion. Use Frisket along the white border (optional). Spot the print to eliminate printing imperfections.

Set out all colors by squeezing pea-sized amounts onto the palette. Arranging the colors in color groups may make your work easier.

2

Preparing the toothpicks and photo

Fray the edges of a ½ × ½ in. (1.25 × 1.25 cm) piece of cotton. Moisten the tip of a toothpick and place it in the center of the cotton. Fold the cotton over the tip and wind the cotton tightly up the shaft, away from the point. Make at least six toothpicks or skewers.

Saturate a cotton ball with Prepared Medium Solution or turpentine. Carefully rub the entire photograph with the cotton, then use a facial tissue to wipe off the excess until the print appears dry. You may need to reprime areas if you continue to work a day or two later. Prepare glossy surfaces with Marshall's Pre-Color Spray. Hold the can 12 in. (30.5 cm) from the print and spray back and forth. After the coating has dried, spray the print using an up-and-down motion. Matte surfaces may need no preparation.

3

Applying color

Use colors straight or mix colors on the palette by blending paint with a cotton swab. Pick up approximately 1/8 tsp of paint on a cotton ball and rub it into a large area, such as the background. Do not worry about keeping the color within a border, but keep rubbing the color until it is smooth and does not glisten when viewed from an angle.

4

Cleaning the print

If color overruns an area, clean it off with a cotton-wrapped skewer dipped in Marlene, extender, or turpentine. Blot the area dry with a tissue. Use a kneaded eraser to remove excess paint from prints treated with Pre-Color Spray.

5

Blending colors

Use your finger (protected with silicon cream), a tissue, or dry cotton to rub paint and blend edges of an area. Always rub down each area and remove excess paint before applying color to an adjacent area.

Use a fresh cotton swab and 1/16 tsp of paint to apply another color to a medium-sized area. Clean the print as previously described. A cotton-wrapped toothpick with less paint or photo pencils will work to apply color in small areas. Paint as much of the image as you want.

6

Finishing the print

Air dry the colored print overnight. If you want to work color into a print that has been colored and dried, use extender or transparentizing gel mixed into the new pigment. The addition of gel or extender makes a color lighter and more sheer.

Carefully remove the masking tape after you have completed the coloring.

Tips *(cont.)*

■ I tend to work from the inside to the outside of an image and to turn the photo upside down so as not to smudge paint already on it. I also find it easier to work with a sheet of clean paper toweling under my wrist and to wait a few hours for the first layer of color to set before adding a hue on top.

■ Days later, paint on a palette may dry and form a skin, but you can prick the skin with a toothpick or skewer, remove it, and use the loose paint underneath. (If a cap on a tube of paint sticks, you can loosen it by holding a lighted match under the cap for a few seconds.)

Chapter 3 TONING

Toning adds color to a black-and-white photograph or Liquid Light Print (see Chapter 12), Van Dyke brown print (see Chapter 7), or graphic arts film transparency (see Chapter 5) by immersion in, or the selective application of, chemical agents. This process can be performed in ordinary room light as an added step after the print has been completely processed and thoroughly washed.

Three different groups of toners are described in this chapter. The first group contains a number of toners that chemically change the silver in a print from black to various other colors. The second group, called *color coupler toners,* plate the silver with a color dye. The third group, *dye toners,* give a uniform color to both image and paper.

Toners in the first group convert silver into other insoluble substances, creating new colors in the image areas but leaving the paper unchanged. The colors you can obtain range from a slight brown, blue, or purple tinge to bright pink or reds. The more vibrant variations usually are produced by using the toners in conjunction with one another. The image alters in relation to its density (the amount of silver buildup or darkness); some solutions tone the highlights first, whereas others begin to color the print's shadows. *Split toning* takes advantage of this characteristic and is obtained by stopping the toning process prematurely, when the highlights and shadows are different colors. Time, temperature, and the type of darkroom chemicals used for processing the print will cause radical variations in color; therefore, consistency in the making of the original prints is imperative if uniform toning results are desired. An added benefit of these toners is that the emulsion is protected from pollutants, so the life of the image is extended.

Color coupler toners also attach to the silver of the image and leave the paper base white, but they use dyes to obtain the final colors. Because they are not so dramatically affected by variations in chemistry, time, and temperature during the darkroom processing of the print, you can anticipate with some certainty exactly what color the toner will impart. The one drawback to this class of toners is that the dyes lack stability and can fade with prolonged exposure to light.

Dye toners color both the image and the base upon which it is printed. The result ranges from a light tint to a highly saturated color. These toners can be used alone or as an additional color in a print toned with one or more of the toners described previously. Color also can be selectively added to the print in a number of ways. Toners may be applied to specific areas with a brush, or parts of the print may be masked before the print is placed into the toning solution. As you work with the toners, you will quickly develop your own methods for controlling color across the surface of the print.

Safety

Before you start to work with any toner, thoroughly read the manufacturer's instructions, any precautions listed, and the safe handling guidelines.

Most toners give off a disagreeable odor, and some, particularly in accidental combination with common darkroom chemicals, can give off a toxic gas. Selenium, for instance, will emit toxic gases if concentrated acids (such as stop bath) contaminate it. Toning must be done in a well-ventilated area. Your work area must have at least *20* complete changes of air per hour, and the exhaust must be pumped out of the building. Selenium toner and sulfide toners, such as Poly-Toner, should only be used under a local exhaust fan.

To prevent any accidental mixing of chemicals on the print, thoroughly wash photos before toning.

Do not inhale any powdered chemicals. Wear an appropriate mask.

Always *add acids to water,* not water to acids.

Contact with the toners can cause allergic reactions, contact dermatitis, and even poisoning. Neoprene gloves must be worn, and the toning solution must be rinsed off immediately should you splash any on yourself. The toning solutions can permanently stain clothing.

Contact your local poison center immediately should you ingest any of the toners.

Avoid toning during pregnancy.

When disposing of the solutions used for toning, flush the sink basin and drain with water after pouring out each chemical. Selenium is considered a hazardous waste and should only be handled by a waste disposal company or by a local household waste program, a service that is usually available free or at minimal cost to noncommercial photographers.

The equipment you use also can become stained; therefore, you might want to have a separate setup for toning. Commercially available tray cleaners may remove some of the stains, but thoroughly wash the trays and flush the sink and drain before you apply cleaners or you may create cyanide gas fumes.

Method Overview

1 For selective toning, a mask can be applied to cover up part of the print.

2 Print is presoaked for at least 10 minutes (30 seconds for resin-coated paper).

3 Print is immersed in the toner, or toner is applied to selected areas.

4 Print is cleared, washed, and dried. Mask is removed.

5 For multiple toning, the clearing bath in step 4 is omitted but the print is thoroughly washed, and steps 3 and 4 are repeated.

Materials

1 Image. Most conventional photographic papers will tone to some degree, but the most dramatic results will be obtained by using a coat-on chloride emulsion as described in Chapter 12 or by using paper such as Kodak's AZO-F surface paper or Chicago Albumen Works' Printing-Out Paper (stocked at Bostick & Sullivan, listed in Supply Sources, in 10-, 25-, and 50-sheet boxes, depending on size). These papers produce warm brownish prints and take

Materials *(cont.)*

wonderfully to gold toner. Although not sensitive enough to use under an enlarger, they work well contact printed with ultraviolet light and the enlarged negatives or photograms described in this book. A special-order item at your photo store, AZO paper comes in both single weight (from 500-sheet boxes, $2\frac{3}{4} \times 4\frac{1}{2}$ in., to 50-sheet boxes, 20×24 in.) and double weight (250-sheet boxes, 8×10 or 11×14 in.). The paper is boxed with a specific contrast grade, from 1 (low) to 4 (high). Printing-Out Paper comes in a 50-sheet package of double-weight 8×10 or 11×14 in. glossy surface, along with its toner. Liquid Light (see Chapter 12), Agfa Portriga Rapid Paper, and Oriental Warm Tone Paper have chlorobromide-based enlarging emulsions and will tone well. Try developing them in Agfa Neutral for rich brown before you tone. If you use graded paper, the stronger the black (usually a higher grade), the more noticeable the toning. Variable-contrast papers might require longer toning times. As your mother probably told you, in most cases you get what you pay for: the more expensive black-and-white papers tend to contain more silver and therefore tone better. The printing process requires constant care so that the prints are not bent or cracked. You may benefit from making both test prints and finished prints of each image.

Resin-coated (RC) papers can be toned, but they do not react in the same way as fiber-based papers, so refer to the instructions packaged with the toner before you start. RC paper cannot be left to soak; tone, wash for around 2 minutes, and dry each print separately. Some commercially produced prints contain no silver when you receive them, and they will not tone.

Different toners best serve photographs with different characteristics. For instance, Berg Brilliant Blue and Fotospeed Blue toners work best with a slightly light print, whereas Sepia, Green, and Copper/Red toners require one that is somewhat dark. Split tones from Kodak and Fotospeed Selenium are best obtained by using moderately high-contrast negatives on a low-contrast grade of paper to render a print with a normal tonal range. You will have to experiment to find the type of paper, contrast level, and tonal range that best works with the tendencies of the toner you have chosen.

The type of chemistry, time in the processing solutions, and temperature of the chemistry when making the original photograph will affect both the overall color and the intensity of a split in color. Developers produce variations in hue, contrast, and tonal range, just as paper does. Any developer can be used with any photographic paper to yield results that you judge as more or less acceptable. Each combination will give a different result when toned; in addition, changing the dilution or temperature of the developer or fixer prior to processing the print will further influence the final effect of the toner on the print. Using fresh developer and fixer will help ensure a crisp, rather than muddy, print and keep the highlights clean after toning.

To avoid mottling the paper base when you later tone the photo, use fresh stop bath at the recommended dilution for the proper amount of time. Always use two fixing baths, each for 5 minutes, in order to prevent the formation of compounds that can lead to staining and a less-permanent print (particularly apparent with blue toners). Fixers can be mixed to different strengths that will have some effect on color. No matter what fixer or dilution you use, however, do not overfix the print. Fixer without hardener will result in a print that will tone more rapidly and evenly, with fuller tones, than prints hardened prior to toning. Two such fixers are Kodak Rapid Fix (without the addition of the hardening solution in the B bottle) and Ilfospeed Fixer.

Adequate washing is imperative. Traces of fixer in the photo or print can cause uneven toning. The advisability of using Hypoclear or Fixer Remover

before toning varies from toner to toner, so read the instructions packaged with the toner before you process the prints. I have been using Berg Bath™ after fixing and after each toning bath. If a tray or tray-and-siphon is used for the final wash, the prints must be constantly agitated to ensure that they are completely free of chemical residue. If you are not sure whether you washed or fixed enough, redo those steps.

Van Dyke brown prints (see Chapter 7) contain silver and can be toned. Proper sizing of the paper (as described in Chapter 4) can prevent an unevenly sized surface or fibrillation of silver nitrate in the fibers of the paper that might cause staining. Van Dyke brown prints can be toned prior to fixing; this is described later in this section under "Formulary Gold Toner for the Printing Out Process." In general, the toning process will affect the density of a Van Dyke brown print, so based on the information given previously for black-and-white paper, start with an image that is either lighter or darker than normal.

2 Toners. Some of the toners that convert silver to other substances are as follows: Kodak's Selenium Toner, Sepia Redevelopment Toner, and Poly-Toner; Ansco Gold Toner 231; Photographer's Formulary Gold Toner for the Printing Out Process; Berg Copper Brown Toner, Protective Gold Toner, Brilliant Blue Toner and Yellow Toner; Fotospeed Sepia, Green, Blue, Copper/Red, Selenium, and Gold Toners; and Rockland Halo Chrome Toner. As you begin to investigate toning, these prepackaged products (which can be purchased at photo stores) allow you to try a wide range of colors.

If you decide on a specific paper and toner combination, you may wish to mix toners from raw chemicals to save money. Formulas appear in many photographic publications, including *The Photo Lab Index* (New York: Morgan and Morgan) and *Processing Chemicals and Formulas for Black and White Photography* (Kodak professional data book No. J-1). If you are unfamiliar with mixing raw chemicals, learn about safe handling and mixing techniques before you start to work. Sources for buying raw chemicals, such as Photographer's Formulary, are listed in the back of this book.

Treat Liquid Light prints just as you would conventional prints, but remember that the surface may be more delicate, so extra care must be taken to avoid damaging the emulsion. To start toning any kind of photo, read the instructions packaged with a given toner, tone a print that way, and then begin your variations. Also, do not exceed the capacity listed in the instructions for the toner you have chosen. The following general guidelines tell you what to expect when a specific toner is used on a photograph, a Liquid Light print, or a Van Dyke brown print. These are suggestions for where to begin experimentation, and are not to be taken as a complete list of possibilities.

Selenium toner doubles the life span of your photo and deepens the blacks if used for a short time, or turns a print purple-black if left to soak for an extended period. Some papers, such as Agfa Portriga and Agfa Insignia, Sterling photo paper, Kodak Elite, and Kodak Forte, will split, with the shadows turning reddish brown and the highlights remaining silvery gray. For a tone change, dilute 1 part toner with 3 to 19 parts of water; if split tones are desired, try a dilution of 1:7 to start. Toning should occur in 2 to 8 minutes at 68°F (20°C).

Selenium toner will increase the contrast of a Van Dyke brown print and change its color to a colder purplish brown. It is best used between the developing and fixing steps during processing (as described in "Formulary Gold Toner for the Printing Out Process," below) or after the fixing has taken place. Try a dilution of at least 1:20, and watch the print carefully because toning occurs rapidly and pales the print.

Materials *(cont.)*

Sepia Redevelopment Toner will impart a yellow-brown color to the image. This toner requires the use of a bleach bath to prepare the silver in the print to accept the toner, and only the silver that has been affected by the bleach will change color. Because the bleach attacks the highlights first, the length of time in the bleach bath can be varied to achieve results ranging from a warm-brown/cold-black split (by using the bleach for 10 to 20 seconds before toning) to a completely brown-and-white print (by bleaching until the image disappears before toning). Because sepia works quickly, I sometimes change the dilution of the bleach beyond the manufacturer's recommendations so that the highlights and midtones are bleached out in less than 5 minutes. Then I wash and examine the print before toning it.

The print may be bleached again after the toning bath. Or the bleach alone with no subsequent toning bath may be used to alter the look of a print. In either case, after bleaching, all traces of yellow must be washed away, and the print should be fixed and washed for the time recommended by the manufacturer.

Mix the toners according to the directions on the package, and take care not to contaminate the two solutions with one another.

Kodak Poly-Toner renders colors that range from the cold black of selenium through the warm brown of sepia, and past that to orange. A simple chart on the bottle lists how to dilute the toner and the amount of time needed to produce the color wanted.

After Van Dyke brown prints have been fixed, they can be Poly-Toned to reduce contrast and shift the color to a warm yellow-brown. When making the print, give it extra exposure to compensate for the bleaching action of the toner that will follow.

Ansco Gold Toner 231, Fotospeed Gold Toner AU20, and Berg Protective Gold Toner will produce rich blue-blacks in a previously untoned print or can be used after sepia toning to get brilliant reds. Be sure to wash the print thoroughly and, to conserve the gold in the toner, cut away any excess exposed print area prior to toning. The formula and instructions for gold 231 can be found in the *Photo Lab Index;* instructions for Berg Protective Gold Toner are included in the package.

Formulary Gold Toner for the Printing Out Process is an excellent toner for increasing the contrast and intensifying the shadow areas of a Van Dyke brown print when used before the print is fixed. It can be mail-ordered from the Photographer's Formulary (see Supply Sources) and includes mixing instructions. After exposure, rinse the print until the water is clear rather than milky, trim the edges of the print to conserve the gold, and place the print in the toner. Watch for a split in tones between the highlights and shadows, pull the print from the toner, and then fix and wash as usual.

Berg Copper Brown and Fotospeed Copper/Red Toner RT20 produce a very different color, much more reddish brown than sepia. When nonhardening fixer is used to process the photograph, the image will turn completely brown, but when a hardening fixing bath is used it will split to copper shadows and gray highlights, particularly when Ilford Ilfobrom paper is used. Mix and use according to the instructions packaged with the toner, but for split tones you may want to remove the print from the toner prematurely.

Berg Brilliant Blue Toner and Fotospeed Blue Toner BT20, which will give you a bright blue image equal in intensity to a cyanotype, work best with a print that is lighter than normal. Use according to the directions packaged with the toner.

Berg suggests the use of a solution of one part Kodak Dektol photo print developer and six parts water to reverse the effect of either copper or brilliant blue toner. The photograph or a Van Dyke brown print is immersed in the solution until it reverts to its pretoned appearance. The print can be selectively redeveloped by coating the area you wish to remain unchanged with a masking agent before immersion. The mask is removed after the print has been washed and dried.

Fotospeed states that persistent yellow stains can be removed in a properly washed blue-toned print. Dilute 1 Tbsp table salt in a 1 qt (0.95 L) tray of water and pass the print quickly through the tray or use a cotton swab soaked in this solution in the affected areas. Rinse the whole print again. Fotospeed also advises an 80% solution of acetic acid on a cotton ball to remove residue scum, and a rinse after toning: "Ideally tone past the point you want to be and wash the print back. Prolonged washing will regenerate the blue tone to black and white, which can be very effective for getting a really clean, crisp blue tone."

Rockland Halo Chrome converts the photographic image to a metallic silver-and-white or black-on-silver. Specific instructions are packaged with the toner.

Color coupler toners include Edwal Color Toners, the Berg Color Toning System, and Rockland Selectchrome.

Edwal Color Toners come in red, yellow, blue, green, and brown. Before use, the toners may be mixed together to make new colors—except for the blue toner, which must not be mixed with any other color. Another way to achieve intermediate colors is to use the toners one after the other, allowing each new toner to change the color of the previous toning layer. To avoid contaminating one color with another, be sure to wash the print well between toning baths. In the darkroom before toning, a hypo clearing agent, such as Kodak Hypoclear, should be used to ensure that the prints are completely free of fixer. Dilute the toners according to the directions, and use immediately.

Berg Color Toning System (not to be confused with the previously described Berg toners) and Fotospeed DY15 Fotodyes also come in a wide range of colors and can be used like the Edwal toners described earlier. One difference from the Edwal toners is that they are packaged with an activator or reducer to help prevent color from appearing in the white areas of the print.

Rockland Selectchrome has colors and possibilities for color manipulation similar to the other toners in this class.

Dye toners include the Rockland Print-tint Toners, which come in a wide range of colors that stain the paper as well as the silver image. They can be used to tone the entire print or can be applied with a brush, but they may not be suitable for selective toning using a masking agent, because only the image area is protected. This leaves the paper base susceptible to the action of the toner.

All these toners can be used separately or sequentially, but the silver-converting toners are most effective in the following order: sepia, poly, copper, selenium, gold. They should be used before toners from the color coupler group, and either group should be used prior to the dye toners. My students have created greens in midtones by using sepia or Berg Golden Yellow first, then blue toner. We have gotten purples from copper before blue. Fotospeed additionally suggests that sepia and then selenium produces brown purples, selenium and then gold produces purplish blue midtones, and blue before selenium creates blue shadow and buff highlights. The print must be thoroughly washed between toning baths to prevent the contamination of one toner with another.

Materials *(cont.)*

3 Trays. You will need at least three trays: one for holding wet prints prior to toning, one for the toning solution, and one for washing the print after toning. You may need more trays for other toners, Dektol, or stop bath. Prints toned in different toners cannot be washed in the same tray, because the toners will migrate from print to print.

The trays must be made of glass, plastic, or enamel and bear no chips or cracks. Metal trays will react to the toning solution and should be avoided. Dish pans can be substituted for photographic trays, but obviously they never can be used in the kitchen again. To avoid uneven toning, the tray must be large enough to accommodate the entire print. The trays often get stained by the toners. These stains can be removed using commercial tray cleaners after all traces of toner have been washed away and the drain has been flushed with water.

4 Masking material. Rubber cement, Luma Liquid Mask, Fotospeed Fotomask, or Photo Maskoid Liquid Frisket™ can be used to mask areas of a dry print before toning and are easily removed when the print has dried.

Rubber cement is readily available and inexpensive. However, it is transparent and difficult to see while being applied. It also has a consistency that is difficult to control. These disadvantages abound when one is trying to mask in a precise and detailed manner. To overcome these problems, mix equal parts of rubber cement and rubber cement thinner with a few drops of red food coloring prior to use. Thinner is also useful for cleaning the brush or applicator.

Photo Maskoid Liquid Frisket and Fotospeed Fotomask are available at some fine arts stores and all graphic arts supply stores. The red color of these products makes it easy to see exactly which sections of the print have been covered, and their consistency aids in the control of detailed areas. Luma Liquid Mask, also sold at graphic arts supply stores, is white. These masking products are removed after the print has been toned and dried.

5 Applicators. Inexpensive watercolor brushes, cotton swabs, or sponges can be used to apply a mask to the print prior to toning and to prepare selective areas to tone. Because brushes may be ruined during these processes, use cheap ones. If you are going to use a brush with a metal ferrule to selectively apply toner, coat the ferrule with rubber cement beforehand as a protective measure. Japanese Bamboo Sumi painting brushes are excellent because they do not have a metal band, but they can be somewhat expensive.

6 Water. Running water near the toning area is required for presoaking and washing the print and for the immediate removal of any splashes or spills. Because impurities and high mineral content in tap water may prevent prints from toning evenly, distilled water is helpful when mixing toner chemicals.

In addition, some photographers presoak their prints in a solution of 1 Tbsp balanced alkali and 32 oz (1 L) distilled water rather than plain tap water because they claim that the photo paper accepts the toner better. Wear a respirator with toxic dust filter, gloves, and goggles when mixing the powder, and keep your hands and eyes protected when using the solution. Do not ingest.

7 Vapor mask and protective gloves.

8 Miscellaneous. A pencil or marker pen, 16 oz (500 ml) or larger graduated beakers, mixing rods, tongs, a sheet of glass with sanded edges to rest the print

on when selectively applying toner, a print squeegee, a darkroom thermometer, a tray siphon from a photography store, and brown bottles to hold 32 oz (1 L) or more of fluid.

Tips

■ As indicated in the Materials section, not all toners are suitable for each of the three methods described in this chapter; therefore, first use a test print to check the activity of the toner and the final color. If you like the result, repeat what you did with the test print exactly. Notes that itemize all the steps a particular print has been through should be made on the back of each print in pencil (resin-coated paper requires the use of a permanent marker such as a Sharpie).

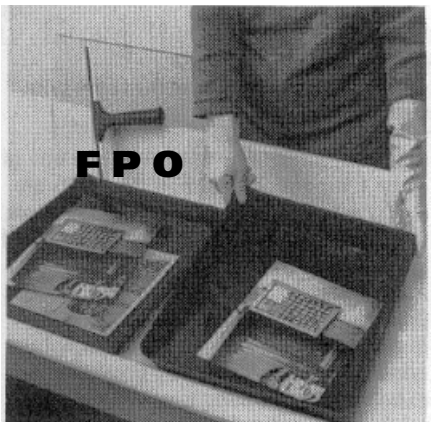
■ It is often helpful to place a wet, untoned print, made on the same paper as the prints to be toned, next to the tray of toner. Because the action of some toners will not be apparent until change is radical, the use of a comparison print will help you to see subtle changes in color.

■ To eliminate the green tint from the black in a black-and-white photograph, to double the life span of your photograph, and to clean up the highlights, dissolve 1 part liquid selenium toner in 11 parts Heico Perma-wash™ or other fixer remover. After exposing and processing the photograph as you do normally (using a fixer without hardener for at least 3 minutes), quickly transfer one print at a time to a tray of toner and Perma-wash. With constant agitation and under good lighting, tone the print until the whites clear up and the blacks turn purplish. Pull the photograph out, place it in a tray of wash water, and wash normally.

■ You can tint (change the color of the image and the paper substrate) with medicinal and food colors. The skin of Bermuda onions, after boiling in water, makes a purple liquid; regular onions treated similarly and brewed coffee or tea yield browns. After any of these tinting liquids have cooled to room temperature, pour the fluid in a photo tray and immerse your photograph with gentle agitation until you achieve the desired color. A few drops of iodine in water makes a yellow tinting agent, whereas mercurochrome handled in the same way produces red.

■ Kodak manufactures double-weight black-and-white polyfiber paper in rolls, which is handled normally in the darkroom. After the image is dry, it can be torn, toned, or drawn on with artists' colored pencils (see Chapter 2) and other media. Kodak stopped making mural paper in 1987.

Toning the Entire Print



1

Presoaking and toning

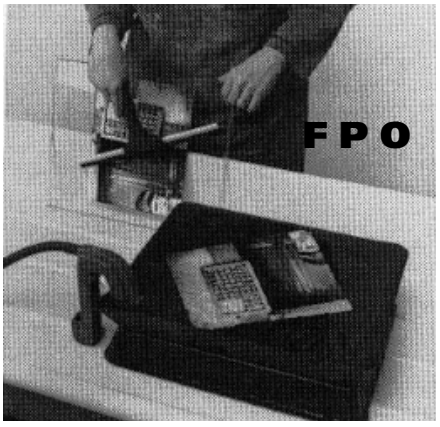
Place all the prints, one at a time, in a tray of room-temperature water. If the prints are dry, presoak for at least 10 minutes. Note that resin-coated prints should be handled individually and should be presoaked for a maximum of 30 seconds. Remove one print from the presoak, and squeegee the front. Immerse it, image side up, in the tray of toner, while constantly rocking the tray to help ensure even toning. Remove the print when the color is a little less intense than desired.

2

Washing

Wash the print for at least 20 minutes (for resin-coated prints, 4 minutes) in rapidly moving 68°F (20°C) water. The prints must not touch while being washed, or stains may develop. Handle the print carefully because toning often softens the emulsion, making it susceptible to damage. Step 1 can be repeated using the same or different toners. Be sure the print is thoroughly washed before it is placed in a new toner.

Split Toning



1

Presoaking and toning

Place all the prints, one at a time, in a tray of room-temperature water. If the prints are dry, presoak for at least 10 minutes. Note that resin-coated prints should be handled individually and should be presoaked for a maximum of 30 seconds. Remove one print from the presoak, and squeegee the front. Keep a wet, untoned print next to the tray of toner to determine, by comparison, when to stop toning (probably 25% less time than you would use for toning the entire print). Immerse the print in the toning bath and pull it out as soon as the shadow areas start shifting to a cold, purplish color. You can either stop at this point or wash the print and immerse it in a second tray of a different color toner until you see the hues you want. With Berg toners, you can overtone in the first toner, immerse the print in developer and stop bath, and then pick another toner color to replace the black areas you have redeveloped.

2

Washing

(See illustration for Toning the Entire Print, step 2.)

Wash the print for at least 20 minutes (resin-coated prints, 2–4 minutes) in rapidly moving water. The prints must not touch while being washed, or stains can develop. Handle the print carefully because toning often softens the emulsion and makes it susceptible to damage. Selenium toner will intensify while being washed, so do not judge the print until it is completely washed. Dry using a blotter roll or on screens with the image side up.

1

Masking the print

Thoroughly coat the areas that are to remain untoned with a generous amount of rubber cement or a masking preparation. Any small spots that are missed will tone and will be obvious in the final print. Allow the mask to dry completely.

2

Presoaking and toning

(See illustration for Toning the Entire Print, step 1, page 38.)

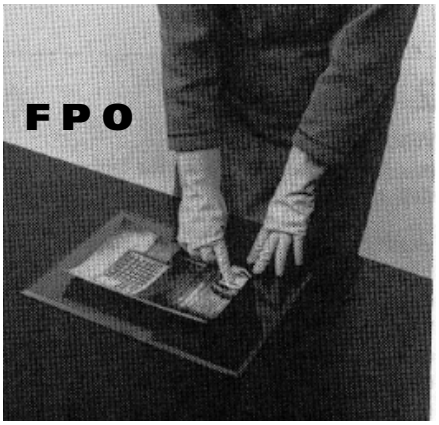
Place the prints, one at a time, in a tray of room-temperature water. If the prints are dry, presoak for at least 10 minutes. Note that resin-coated prints should be handled individually and should be presoaked for a maximum of 30 seconds. Remove one print from the presoak and immerse it, image side up, in the tray of toner, while constantly rocking the tray gently. Avoid extremely long toning times, during which toner might seep under the mask.

3

Washing

(See illustration for Toning the Entire Print, step 2, page 38.)

Thoroughly and carefully wash the print for at least 20 minutes (resin-coated prints, 2–4 minutes) in rapidly moving water. Prints must not touch while they are being washed, or stains may develop. Handle the print carefully because toning often softens the emulsion, making it susceptible to damage. Air dry face up.



4

Removing the mask and optional retoning

When the print is thoroughly dry, use celluloid tape on a corner and peel the mask or carefully rub the surface of the print to peel the mask. If desired, the print could be masked again, the untoned areas of the print split toned, or the entire print placed in a different toning bath.

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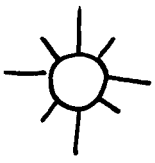
Part II

PREPARATION FOR LIGHT-SENSITIVE METHODS

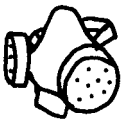


Daylight

Subdued Light

Safelight

Protective Gloves



Respirator

Chapter 4

CREATING THE PHOTO-PRINTMAKING STUDIO

EQUIPMENT

Many of the printmaking processes described in Part III, Light-Sensitive Methods, are accomplished without a photographic darkroom or film-developing area, although an artist may want access to a darkroom for making large negatives (see Chapter 5). Cyanotype, Van Dyke brown, gum bichromate, casein pigment, and Kwik Print* emulsions are applied to paper or fabric in subdued daylight, dried, exposed to bright ultraviolet light under black-and-white transparencies, and developed in water. A light box for viewing negatives, a contact printing frame for holding negatives in place against the photo-printmaking emulsion, and an exposure unit of ultraviolet light all become indispensable once you start using them. This chapter shows how to build these items easily and relatively inexpensively. Technical information on choosing and sizing paper, registering negatives, and utilizing graphic arts aids is given in the Materials and Procedures section (beginning on page 54) of this chapter.

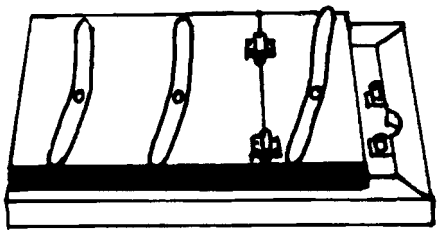
The Light Box

Most graphic arts and photography stores sell light boxes for viewing and touching up transparencies and for cutting and taping them into masking sheets. If you buy a light box, make sure it has a glass top or buy a sheet of glass to fit on top, so that when you cut masking sheets and negatives with a stencil knife you will not scratch the opal Plexiglas or white plastic viewing surface. *Build Your Own Home Darkroom* (see the annotated bibliography in the back of the book) provides detailed instructions for making a high-quality light box at about one-third the cost of purchasing one.

You can create a simple light-viewing system with a desk lamp, storm window, velum, and three chairs. Simply set up a gooseneck lamp on a floor so that the light bulb faces upward. Using clear cellophane tape, attach a sheet of tracing paper or drafting vellum to one side of an old storm window. Using three chairs of equal height, place two on either side of the lamp and one behind it. Lay the storm window, glass side up and vellum side down, securely on the chair seats. Make sure that the lamp is far enough away from the paper or vellum (used to diffuse the light) that it does not overheat.

*Please note that Kwik Print may not be manufactured after 2000. See explanation in Introduction.

The Contact Printing Frame



An altered contact printing frame.

Whether creating multicolored images or monochrome pictures, you will need a way to hold the negative in strict contact with the photo-printmaking emulsion during the exposure. If the negative is not tightly touching the emulsion, a blurry or double-exposed image might result, causing problems in the readability of the image. If you like blurry images, however, you have more control if the negative itself is out of focus.

You can buy a contact printing frame at a photography store, usually as a special-order item. Common, useful ones are made by Premier and Bostick & Sullivan, listed in the Supply Sources at the end of this book. Artist Jesseca Ferguson enthusiastically endorses handmade printing frames from Great Basin Photographic (see Supply Sources) for their ease of use and excellent contact pressure. You might find a bargain-priced contact frame at a flea market; after all, the originators of these photo-printmaking processes made their exposures in sunlight with a contact printing frame, as illustrated on page 108 (Panorama of Talbot's Reading Establishment).

The frame, which usually comes in standard photographic paper sizes such as 8 × 10 in. (20.25 × 25.5 cm), 11 × 14 in. (28 × 35.5 cm), or 16 × 20 in. (40.5 × 50.75 cm), is a piece of glass surrounded by wood for the top and a hinged two-piece wood bottom lined with felt. Spring clips on the back slip under the frame to lock it, thus securing the contact between emulsion and negative, sandwiched inside. One of the spring clips can be released during the exposure without disturbing the position of the negative so that part of the bottom can be opened at the hinge, allowing the emulsion and image to be checked. This feature is particularly helpful with cyanotype and Van Dyke brown printing, where exposure time is based on a visible change of color.

If you intend to use a registration system for lining up negatives when creating multicolored prints, you need to buy a frame one size larger than the print size in order to accommodate the registration pins and masking sheets. To avoid breaking the glass when you close the frame, you will also need to saw off about ½ in. (1.25 cm) from the wood back and to tape the registration pins onto the glass at this margin.

An alternative to buying a contact frame is making one, quickly and for one-third the price.

Safety

To lessen the risk of cuts when you handle sheet glass, either have the glass beveled or sanded or use heavy tape to cover all edges. Be aware that tape will block light during an exposure.

Materials

1 Registration pins. Registration pins are metal buttons mounted on thin sheets of steel. They can be purchased at graphic arts and printing supply stores. The height of the buttons varies from 3/64 in. (1.75 mm) to 3/8 in. (1.5 mm); diameters usually are 1/4 in. (9.75 mm). You will need at least four pins, which must match the diameter of the hole punch (see item 2). Two to three registration pins must be mounted on a light table for lining up and punching holes in the negatives or masking sheets, and two to three more are needed on the contact printing frame. How to register the negatives on a light table is explained further on pages 54–55.

The Contact Printing Frame *(cont.)*

2 Registration punch. For images 11 × 14 in. (28 × 35.5 cm) or smaller, you need to purchase an inexpensive two-hole punch such as a Punchodex No. 49 at an office supply store; larger negatives require a three-hole punch. Make sure that the punch creates holes with a diameter to match the diameter of your registration pins, usually ¼ in. (9.75 mm).

3 Masonite, pressed wood, or plate glass. The board, which becomes the backing, should be at least 1½ in. (3.75 cm) longer and 1½ in. wider than the sheets of paper on which you print because you need extra space for the registration pins. Make sure the board is not warped. Richard Sullivan suggests using plate glass instead of board (*Labnotes,* page 9; see bibliography).

If you use perforated hardboard from a lumber yard, you could devise a box to go underneath and attach the hose from a vacuum cleaner, thus creating a vacuum pin registration board that will not allow paper to move even slightly. Or, you could attach the pins to a sheet of glass with silicon cement to create a transmission pin registration board.

4 Glass. A sheet of plate glass, although expensive, is worth the extra investment because it really weights the negative down. Hardware store window glass, which is ¼ in. (9.75 mm) thick, will do, or a discarded storm window can be recycled. The glass should be slightly larger than the printing paper. Make sure the glass is not the kind that blocks ultraviolet light.

5 Tape. You will need 1½ in. (3.75 cm) wide cloth or duct tape for two purposes: adhering the registration pins and hinging the glass. You may also need it for masking the sharp edges of the glass.

6 Foam rubber or polyurethane foam (optional). For extra give when the glass presses down on the negative and to create stricter contact between the negative and the emulsion, a sheet of ⅛ in. (5 mm) thick foam, a sponge rubber pad such as the type used for an area rug, or felt can be attached to the board with glue. The padding should be the same size as and line up with the glass. If you use this foam backing, buy registration pins taller than ⅛ in.

7 Index card stock or scrap sheet film. You will need a sheet the same length as your hole punch.

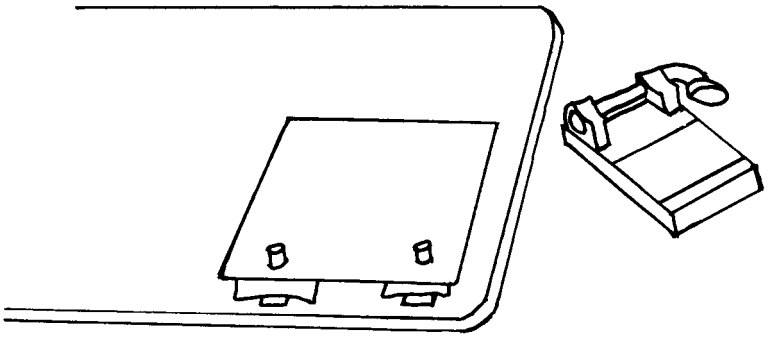
8 Marker. A red ballpoint pen, permanent felt-tip marker, or lithographic red pen sold in graphic art stores is necessary.

Tips

■ If you have taped around the edge of the glass to prevent cutting your hands, the tape will block light during the exposure and result in a border on the printing paper.

■ If you want to work to the edge of the paper, you will need to tape your negatives to hole-punched masking sheets or clear sheets of cellophane, as explained on page 54. You can buy inexpensive, reusable registration tabs from a commercial printing supplier or graphic design store. Attach them to the board with durable tape so that the edges of the printing paper fit underneath. Be careful not to move them while you work.

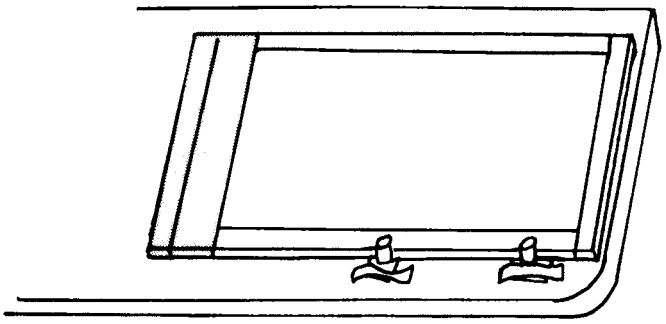
Making a Contact Printing Frame



1

Attaching registration pins

Insert index stock to the far inside edge guide of the hole punch, and make a set of holes in it. Relocate the index stock on the piece of Masonite so that holes are close to the board's edge on the lower half of the board. Insert registration pins through the holes from the underside and tape them to the board.



2

Attaching the glass

Remove the index stock. Place the glass so that one of its edges abuts the registration pins. The edge of the glass that is at a right angle to the registration pins and near the edge of the board should be lined up with it. Using a strip of strong tape, hinge the glass to the board on the opposite side.

■ The Premier frame may need an extra layer of felt to promote tight contact printing. You can replace broken glass with window glass from a hardware store.

The Exposure Unit

Graphic arts and printers' suppliers sell plate makers, which are a contact printing frame and exposure unit combined. They are terrific for photo printmaking but are extremely expensive. If you do buy one, make sure that if the light source is a carbon arc lamp, which gives off dangerous fumes, it is thoroughly vented. Other safer sources of ultraviolet light are fluorescent, quartz, or pulsed xenon bulbs. Palladio™ Co., Inc. and Edwards Engineered Products manufacture exposure units. See Supply Sources for more information.

An inexpensive exposure unit can be made by hanging a reflector with a sunlamp bulb (not a red infrared bulb), a 500-watt or 1000-watt photoflood bulb, approximately 15 in. (38.1 cm) to 30 in. (76.25 cm) above the photoprint. (Using a 750- to 1000-watt quartz light bought at a professional photography store is more expensive, but more efficient.) Be careful not to look at the bulb when it is on, or you will damage your eyes. The problem with these methods is that the exposure times are long, and if you bring the light closer

The Exposure Unit *(cont.)*

you must check to make sure that the glass on the print frame does not overheat and crack.

Sunlight is the least expensive exposure method, and it is splendid for cyanotypes and Van Dyke brown prints. Unfortunately, for critical techniques such as casein, gum, and Kwik printing, sunlight is not dependable all year round and is not consistent throughout a day, making for varying exposure times even with the same emulsion.

I have found that building an exposure unit with black light fluorescent tubes is well worth the investment. Although relatively inexpensive (under $250 in U.S. dollars) given access to tools, the labor can be as intensive as 4 to 8 hours. The following instructions are for making a unit that will expose an area up to the size of standard printmaking paper, 26 × 40 in. (66 × 101.5 cm). The instructions can be adapted for larger or smaller units if you remember that each fluorescent tube will expose a 4 in. (10 cm) width when placed 6 in. (15.25 cm) above the printing frame, and if you make sure the fixtures remain approximately 2¼ inches (5.75 cm) apart. Light fixtures and tubes come in different lengths.

Following the advice of the Palladio Co., I have mounted a 115 volt (100 CFM, 4 11/16 in.) axial fan through a hole cut in the back of my fluorescent light unit and wired it to the on/off switch already on the unit, because the bulbs heat up as they are used. Once they surpass 100°F (38°C), they give off less light, demanding an increase in exposure time, which in turn means the bulbs burn longer and heat up further. In addition, I cut an air cooling slot on the end wood piece as advised by Dick Sullivan and Carl Weese in *The New Platinum Print* (see Bibliography). The slot is close to a wall, so I do not look at ultraviolet light when the unit is on. An alternative approach would be to drill 1 in. (2.5 cm) holes on each side of the unit and put foam or a vent over each one, so that air, but not light, passes through.

Safety

Never purposely break a fluorescent tube—it contains poisonous metals, and the glass can cut.

Do not connect other electrical appliances on the same socket as the exposure unit.

Electrical work can be dangerous if approached incorrectly. The instructions in this book are intended as a guide so that you can discuss the job with an expert. All installations should adhere to local codes.

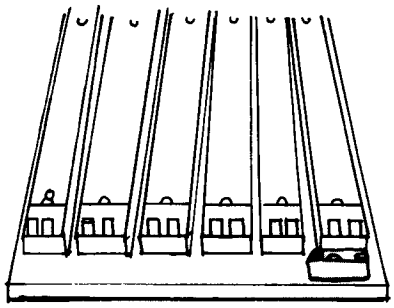
Although the information in this book is as near to complete as possible at the time of publication, the publisher and author cannot assume liability for any changes, errors, or omissions leading to problems you may encounter.

Make sure you read the Tips section on page 50 *before* you start.

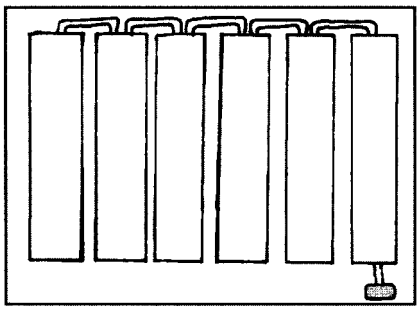
Materials

1 Tools. You will need a metal tape measure or yard/meter stick; a pencil; a hand saw, jigsaw, or skill saw; a drill and 1/16 in. (2.5 mm) drill bit; a Phillips-head screwdriver; a hammer; a sharp utility knife or wire stripper; a wire cutter; pliers; a small slotted screwdriver; and a T-square or combination square.

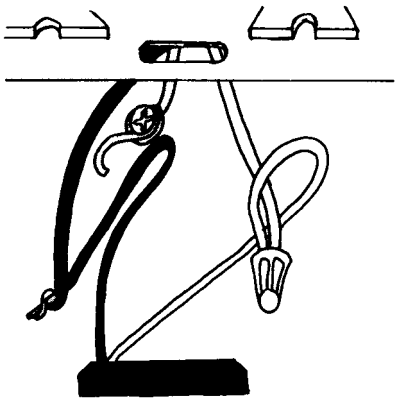
2 Wood. Cut one 10 ft (3 m) length of 1 × 10 in. (2.5 × 25.5 cm) #2 common pine board into two 31¼ in. (79.5 cm) lengths and one 42 in. (106.75 cm)



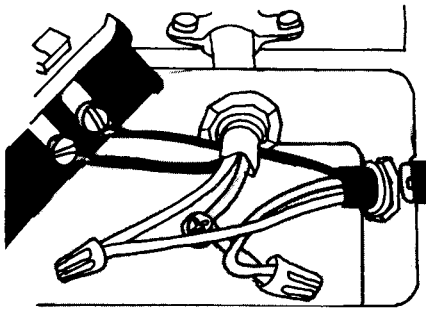
1 **Handy box and fixtures are screwed down to plywood.**



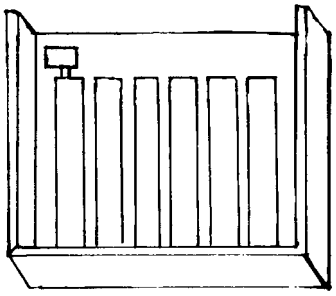
2 **Six lengths of cord are cut, and five are looped between each fixture. At the nonlooped end of an outside fixture, the sixth piece of cord is connected between fixture and handy box.**



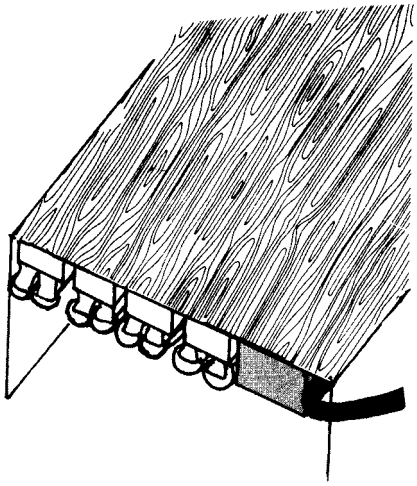
3 **The insulation from both ends of the cord is partially stripped, revealing the colored wires inside, which also are partially stripped. Black wire twists around black fixture wire, and white around white. The copper wires are twisted and grounded and all wires capped. (Some fixtures are made with green grounding screws threaded into fixture bodies.)**



4 **The SJ cord is entered into the handy box, and the black jacket insulation is stripped, revealing colored wires inside, which also are partially stripped. Green and copper wires are twisted, capped, and grounded. White twists around white and is capped. The black wire from the SJ cord is twisted around a screw on the switch. The black wire from the Romex cord is twisted around another screw on the switch.**



5 **Three 1 x 10 legs are nailed to the plywood, two on either short side and one on the side opposite the switch.**



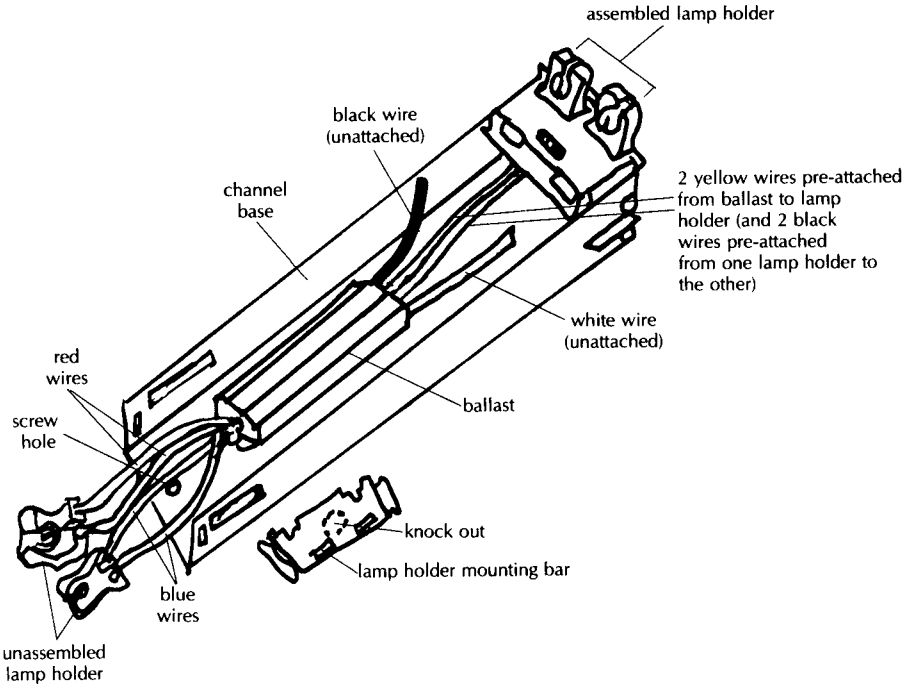
6 **The plate cover is attached to the handy box. The plug is wired to the SJ cord. The bulbs are inserted into the fixtures, and the unit is overturned.**

length to make legs. A sheet of 32 × 42 in. (81.25 × 106.75 cm) plywood ½ in. (1.25 cm) thick is used to build the top. When you go to the lumber yard, you can have them cut the 1 × 10 board and the plywood. Insist that the grain of the plywood matches the direction of the 42 in. length. Otherwise, the weight of the bulbs and fixtures will eventually cause the wood to sag.

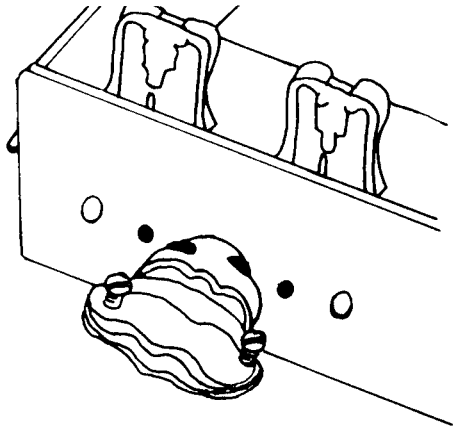
3 Fluorescent tubes. Buy twelve 24 in. (61 cm) black light fluorescent tubes, labeled F20T12/BL by General Electric and Sylvania and available at an electrical supplier. They are a specialty item and should not be confused with the black lights used to grow plants. Dick Arentz (author of *An Outline for Platinum/Palladium Printing*) recommends SA (Super Actinic) tubes—which are stronger but slightly more contrasty, according to Judy Seigel (editor of *Post Factory Photography*)—and AQA (Aquarium) tubes as more efficient.

4 Fluorescent strip fixtures. Buy six two-lamp 24 in. (61 cm) rapid- or trigger-start strip fixtures at an electrical supplier. A fluorescent fixture comes partially assembled with a U-shaped channel base, which includes the boxlike ballast, wires, and two lamp holders. You also get two sets of parts: mounting bars for the lamp holders and fixture end pieces, and a flatter top of the same metal and length and width as the base.

On a sturdy table, place the base so that the ballast and wires face up. Stretch the lamp holders and wire to each end of the fixture to which they are nearest. The lamp holder mounting bar then clips or bolts onto the slots on either side of the base near the end. Spread the sides of the base and insert the leg of the mounting bar so that the two cutout parts face out and the top of the mounting bar is flush with the height of the sides of the base. The lamp hold-



Partially assembled strip fixture.



Assembled Romex connector.

ers slide into the cutout parts with the flat side flush to the end and with the holders secure and perpendicular to the base. These lamp holders will hold the fluorescent tubes. (Some fixtures come with the lamp holders already assembled.) Tuck the wires inside the channel of the base, making sure they are not pinched.

Take one of the end pieces and extend it across the end closest to the ballast (farthest from the black-and-white wires). The end piece is cut so that the leg of the lamp holder mounting bar fits into the slot. Gently hammer the end piece to a flush position. Notice the round indentation, or *knockout,* in the end piece you have not used; carefully remove the knockout with pliers or a hammer and screwdriver. Some knockouts can be removed by hand. Unscrew the lock nut from a Romex connector (see item 8), then push the neck of the connector through the knockout so that the part with the clamp faces out and the lock nut is on the inside. Screw the lock nut back to the connector so that it is snug and does not wiggle; then attach the fixture end to the base, making sure that the screws on the connector face up toward you.

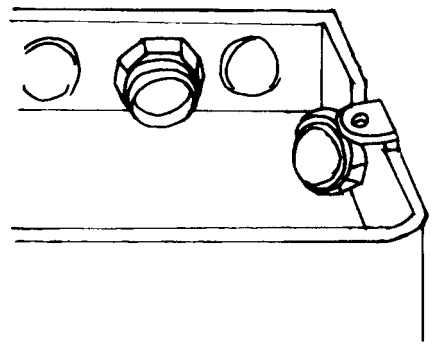
Assemble the other fixtures in the same way. One fixture must have connections on both ends.

5 Three-conductor cord. Buy approximately 6 ft (1.75 m) of 16/3 SJ cord to connect the exposure unit to a wall socket. Buy 15 ft (4.5 m) of 14/2 Romex nonmetallic sheathed cable with ground wire. This white Romex cord is used to connect each fixture to the next. Both types of cord are available at electrical suppliers.

Three-conductor means that the cord is made up of a black (live) copper wire, a white (neutral) copper wire, and a green (ground) copper wire.

6 Three-prong plug and (optional) three-prong adapter. The plug is called a *male cord cap* and can be found at an electrical supply store. The adapter is needed if your wall socket will not accept three prongs. You also will need a single-pole 15 amp switch.

7 Medium wire nuts. You will need 15 wire nuts, purchased from an electrical supplier or hardware store, to join the white, black, and green wires to wires of the same color. If any of these wires are not long enough, extend them using extra wire and wire nuts, such as Eagle #44 wire nuts.



Handy box with Romex connectors attached.

8 Romex cable connectors. You will need nine, to attach to the light fixture and handy box (see item 9) to prevent the cord from rubbing against abrasive edges.

9 Handy box and handy box switch cover and grounding screw. This is an electrician's metal fixture box.

Use pliers to remove two knockouts in the handy box: one in the middle of the long side of the box and one at the end of the box. Attach Romex connectors (as described previously in item 4) in each of these knockouts.

10 Screws. Fourteen 3/4 in. (2 cm) self-tapping (pan head) sheet metal screws can be purchased at a hardware store. Twelve will mount the fixtures to the plywood, and six of these twelve also will serve as a ground for the wire. Two screws mount the handy box to the plywood.

11 Nails. Buy 1 pound (0.5 kg) of 8 penny finish nails.

The Exposure Unit *(cont.)*

12 Tape (optional). Aluminum, stainless steel, electrical, or cloth tape approximately 1½ in. (3.75 cm) wide may be used to secure the wires to the sides of the exposure unit to keep them out of the way as you work. Alternatively, you can staple the wires, making sure the staples go across and over the wires rather than through them.

Tips

■ The way to strip Romex cord is to take a sharp utility knife and slice a groove down the middle. Then, peel and cut off the outer jacket. Remove the cardboard that surrounds the bare copper ground wire. After stripping, check wires to see that insulation is intact.

■ Make sure that the outside jacket of both Romex and SJ wire is under the Romex connector, and that you tighten the connector onto the jacket, not onto bare wires.

■ Always twist wire clockwise.

■ You should never see bare copper wire after twisting on a wire nut. Black and white wires are power wires, but it does not matter if the copper from the ground wire shows.

■ Pull on the cord to make sure the wire nut is secure.

■ No wire should be showing where you connected the plug.

■ While attaching the legs to the plywood, you should ask a friend to work with you. One person can hold the board in place, flush to the plywood edges, while the other person hammers.

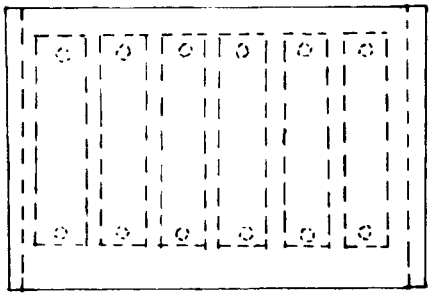
■ The fixture covers should hide the ballast and wires.

■ Dust the bulbs before using the exposure unit. Accumulated dust will block light, thereby lengthening exposure times.

■ I made one exposure unit with a galvanized aluminum lining and found that because the light reflected off the shiny metal, exposure times for printmaking were shorter. I have also seen exposure units painted white on the inside or lined with aluminum foil from the grocery store.

■ I plug my exposure unit into a GraLab timer (see item 9, page 68), and then plug the timer into a wall socket.

■ Fluorescent lights will deactivate magnetic cards, such as charge cards, placed under them.

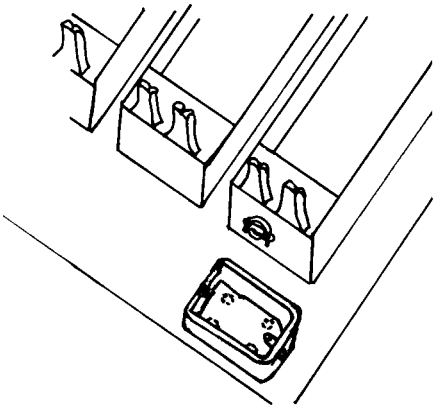


1

Mounting the fixtures

On the plywood, draw lines 1 in. (2.5 cm) in from both of the 32 in. edges to indicate where the 1 × 10 pine board legs eventually will be nailed. Draw lines $2\frac{3}{8}$ in. (6 cm) in from the 1 in. lines to represent the spaces between the legs and the end fixtures. Each fixture is 4 in. (10 cm) wide, and each space between those fixtures will be $2\frac{1}{4}$ in. (5.75 cm). Continue by drawing lines for the six fixtures and five remaining spaces.

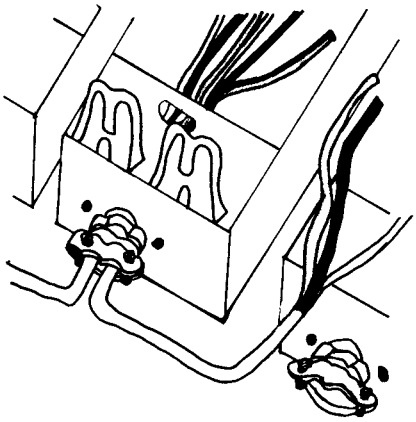
Lay out the fixtures, centered vertically, on the plywood, with the channel facing up. Put a pencil through the screw holes to mark the wood. After removing the fixtures, drill shallow holes at each of the marks. Replace the fixtures and screw but do not tighten them into the plywood.



2

Mounting the handy box

Place the handy box on the plywood, with the opening facing up and switch pointing out, so that it is $1\frac{1}{2}$ in. (3.75 cm) from the head of the right outside fixture. Mark, drill, and screw the handy box into the plywood through the machined screw holes on the box.



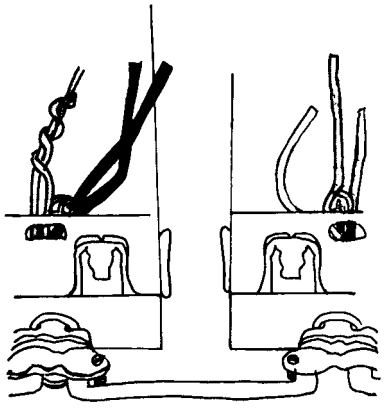
3

Connecting the fixtures

Using wire cutters, cut five 30 in. (76 cm) pieces of Romex. Taking care not to slice the insulation covering each wire, use a utility knife to strip 10 in. (76.25 cm) off the jacket from both ends of each piece of Romex. Starting from the outside, insert the end of one 30 in. piece into the channel of the Romex connector in the right fixture until the sheathing is under the connector. (Do not wire the same end as the handy box.) Screw down the connector until the cord is snug but not overtightened.

Insert the other end of the cord into the second fixture, but do not screw down the connector. Take another piece of stripped Romex wire and insert one end into the second fixture; screw down both ends into the connector.

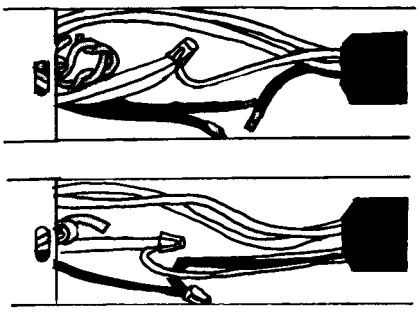
Insert and screw down the other end of the second piece of cord into the connector of the third fixture with the end of a third piece of cord. Continue to loop pieces of cord in a similar fashion, making sure by bending the cable that the wires do not hang out beyond the plywood.



4

Connecting the grounds

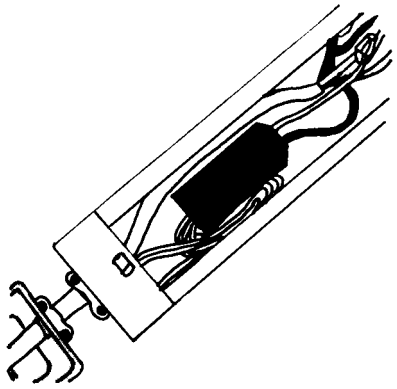
On the first fixture, wrap the bare copper wire (again, the fixtures may come with a green grounding screw) clockwise around the mounting screw, then tighten down the screw head. On the middle fixtures, twist the two copper wires tightly together clockwise a few times with the pliers. Take one of those copper wires and forcefully wrap it around the mounting screw, which is then tightened down. Do this to each fixture.



5

Connecting the wires

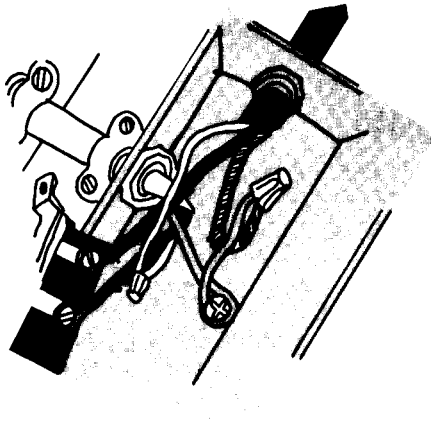
Use the utility knife to strip ¾ in. (2 cm) of insulation off all remaining black and white wires inside the Romex cord. The next four fixtures will have three white wires (two that you strip and one already stripped coming off the ballast) and three black wires in a similar state. Use pliers to twist the two white Romex wires together, then snip them off so that approximately ½ in. (1.25 cm) copper wire remains. Wrap the white wire from the ballast to the other two spliced white wires, then screw on a wire nut snugly, so that no copper wire is showing. Connect all remaining sets of white wires together and all sets of black wires together in like manner. The outside fixtures each have two white and two black wires, which are twisted white to white and black to black and capped.



6

Wiring the handy box

On the end closest to the handy box, attach a Romex connector to the knockout in the right outside fixture. Insert the remaining 30 in. piece of partially stripped Romex cord through the Romex connector so that the cable passes the ballast and reaches all the black and white wires at the far side. Insert the other end and the rest of the cord through the closest connector on the handy box. Screw down both connectors. Strip ¾ in. (2 cm) off the black and white conductor wires on the far end. Twist the three white wires together and screw on a wire nut. Twist the three black wires together and screw on a wire nut. Twist the two copper wires—one from the Romex and one from the fixture—together and cap them. (The copper ground wire from the fixture should have been wrapped clockwise around the mounting or grounding screw, as described in step 4.)



7

Connecting the SJ cord

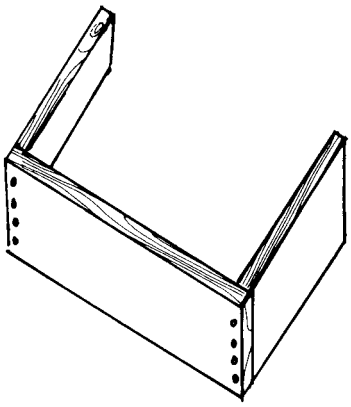
Carefully strip 5 in. (12.5 cm) off the jacket at one end of the cord, and starting at the outside, enter that end of the SJ cord through the unused connector of the handy box, then screw down the Romex connector. Strip ¾ in. (2 cm) off the sheathing of the green ground wire inside the SJ cord. Twist the green wire to the copper wire of the Romex cord and screw on a wire nut. Twist the copper wire once clockwise around the grounding or mounting screw and tighten it down. Twist both white wires together and cover with a wire nut. Twist one black wire clockwise around the screw on the outside of the switch, and twist the second black wire to the other screw outside the switch. Tighten both screws, and cover them with a strip of tape.

Gently fit the switch on top of the handy box. Using the two screws on the switch, fasten the switch to the metal tabs on the box using the machined holes. Place the cover over the switch and use its screws to attach the plate to the switch at the machined holes.

8

Attaching the plug

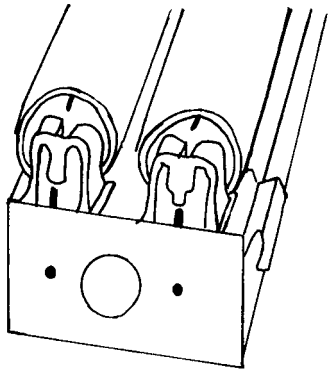
Unscrew and detach the prong part from the male plug. Carefully strip approximately 1½ in. (3.75 cm)—some devices have stripping guides on the fixture or on an instruction sheet—of rubber insulation off the SJ cord and slip the male plug part over the cord to the edge of the insulation. Strip ¾ in. (2 cm) insulation from all three conductor wires, and twist each one separately so that it forms a more solid wire. Wrap the copper wire clockwise from the green ground to the green screw. Wrap the white wire clockwise around the silver screw, and wrap the black wire clockwise around the brass screw. Tighten all three screws and replace the prong part by screwing it down from the outside.



9

Making the legs

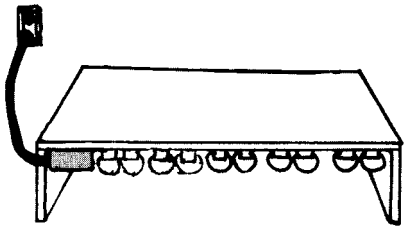
On the 1 × 10 board, use a tape measure, combination square, and pencil to mark off two 31¼ in. (79.5 cm) pieces and one 42 in. (106.5 cm) piece. Cut the pieces or have a lumber yard cut them. Abut the shorter pieces to the longer piece on either end of the longer piece. Starting 2 in. (5 cm) in from the top and bottom, hammer four nails into the corners. (Do not nail the short pieces to the end grain of the 42 in. piece.) Place the fixtures mounted on the board on top of the newly constructed legs. The handy box should be at the open end and facing down. Nail from the outside of the plywood to the width of the 1 × 10s. Use four nails, spaced evenly and starting 2 in. (5 cm) from either end, on each of the short sides. Hammer nine nails along the 42 in. side, again starting 2 in. (5 cm) in from the corners and spacing evenly.



10

Testing the fixtures

Snap the fixture covers on so that they gently force the wiring down and securely attach to the fixtures. Insert the fluorescent bulbs, two to a fixture, by fitting the prongs into the channels on the lamp holders and gently twisting them until they take hold. Plug the unit into a ground fault interrupt circuit (GFIC), turn it on briefly, and make sure it works. *Do not look directly at the bulbs unless you are wearing special ultraviolet goggles.* If the lights do not go on, unplug the system and make sure that the bulbs are inserted correctly or that the grounds are properly connected on the ballasts.



11

Finishing the exposure unit

Remove the bulbs, unplug the unit, and turn the unit over so that the switch faces you. Reinsert the bulbs, plug the unit into a wall socket, turn it on, and go to work! (You may want to install handles for transportability of the unit and to install a removable opaque flap or door on the front to prevent your accidentally viewing dangerous ultraviolet rays. My exposure unit has a hinged door.)

MATERIALS AND PROCEDURES

The photo-printmaking techniques described in Part III use liquid, light-sensitive emulsions (or coatings), which you mix and apply to paper or fabric. You should read the preparation procedures described next before you start any of the processes. They may save you time and prevent frustration.

Materials

1 Image. You will need a transparent or semitransparent image, which can be used over and over again. Except for the enlargement emulsions discussed in Chapter 12 and the Bromoil and Chromoskedasic processes described in Chapter 11, the printmaking processes that follow are contact speed; that is, they are not light sensitive enough to take into a darkroom and enlarge onto. You need to create negatives that are the same size as the finished picture. The emulsions reverse the negative transparencies to a positive print, or vice versa.

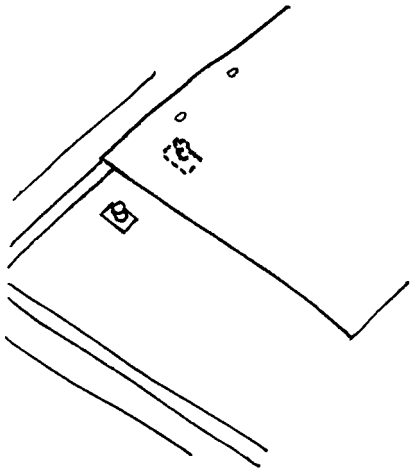
As described in Chapter 5, Making Negatives, transparencies can be made photographically in a darkroom or nonphotographically by hand. You can place the negatives wherever you want on the emulsion. The edges of the transparency should be trimmed precisely, because the excess black film around an image will print as a random white border.

Blueprint/Printables produces yards of fabric without a transparency—they use flowers, vegetables (such as red hot chili peppers) and chain link fencing to block light, thereby creating solid shapes.

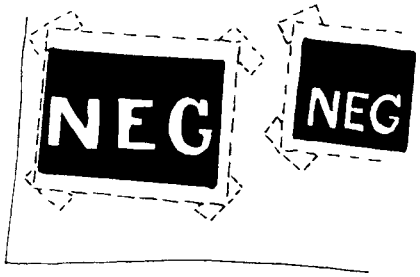
2 Masking sheets. Red acetate or ruby masking sheets, which you cut to the size of your printing paper, are available from graphic design and printing suppliers. Although see-through, masking sheets do block ultraviolet light and keep the covered paper—even paper with emulsion on it—unchanged. As described below, you will cut a window slightly smaller than the negative, which is affixed to the masking sheet with narrow-width ruby or red cellophane tape. Do not use amberlith or paper masking sheets, because they do not block enough of the exposure light. (If you want the coating to show, negatives can be attached with clear *cellophane tape* or, even better, film makers' clear tape, to sheets of clear acetate or cellophane.)

To mask gum, casein, and Kwik Prints, where you will probably employ more than one coating of emulsion, you may use many negatives, printing a negative in one color on top of another color. Photographic color separations or posterizations of the same images, for instance, as described in Chapter 5, are divided according to what color you want them to print. All negatives to be printed one color are attached to a masking sheet in the exact position where you want them to print. This exact positioning of negatives is called *registration*. To register negatives properly, you really need a light table, registration board, and registration pins, as described on page 43 of this chapter. Read that section before proceeding with the following instructions.

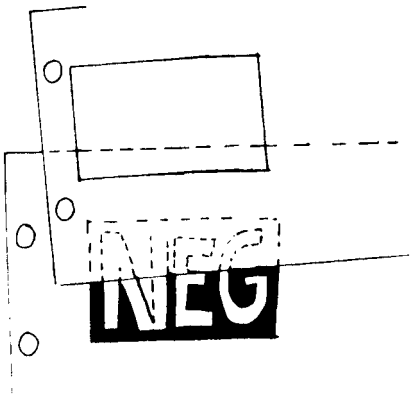
Insert index stock to the far inside edge guide of a hole punch and make a set of holes in it. Relocate the index stock onto a light table and insert registration pins through the holes from the underside. Tape the pins to the light table. Remove the index stock and place a masking sheet, previously cut to the size of your printing paper, under the index stock so that the edges of the masking sheet and index stock are flush. Use a permanent marker pen to draw circles through the holes onto the masking sheet, and punch holes at those positions.



Registration pins attached to light table and see-through rubylith masking sheet punched to match pins.



Negatives stripped to masking sheet.



Second masking sheet, with holes punched to match first sheet.

Put the holes of the masking sheet onto the light table registration pins. Place the negatives intended for the same coating of emulsion so that they read correctly on the light table. Attach tape, sticky side up, halfway onto the borders of the negatives and half unattached. Move the negatives until they are positioned under the masking sheet, then pat the masking sheet to the unattached half of the tape. Use a sharp stencil knife to cut and remove windows made on the masking sheets slightly smaller than the negative. This is called *stripping* the negative.

Punch holes in another masking sheet as you did before. Place it over the first masking sheet. Attach tape as you did before to all the negatives intended for the second coating of emulsion and adhere them, one by one, to the underside of the second masking sheet, making sure you have visually lined up the negatives with the ones from the first masking sheet. Continue in this manner with each set of negatives, cutting windows as you need them.

Tape a set of registration pins to the contact printing frame (see page 43) in the same way you just taped them to the light table. A stripped-up masking sheet plus the identically punched printing paper will be held in place during each exposure by the pins.

I have used rubylith shapes *on top* of the glass during part of an exposure to hold back light from an area that becomes too dark in the print. If you place the rubylith piece under the glass, it leaves a sharp edge in the print.

3 Supports. Paper can be made from a variety of materials, usually wood pulp and rags. Acid aids in the manufacturing process, and poorly refined wood pulp paper decomposes quickly. Some relatively inexpensive pulp papers are buffered to produce neutral acidity, which extends the life span. One such paper ideal for making practice prints is Archivart Standard. This paper is also recommended as a barrier sheet in the storage of prints; the manufacturer (Process Materials) is listed in the back of this book under Supply Sources.

Rag papers, although more expensive, tend to be long-lasting and of pleasing tactility. Those made with cotton really print well with the photo processes. Based on availability, absorbency, archival properties, and expense, I recommend one of the following: Buxton ("extra white"); Rives lightweight (an off-white color) or its equivalent in thickness, Arches 90 lb hot press (whiter); Rives heavyweight or its equivalent, Arches 140 lb; Rives BFK, which comes in white and a few colors; Aquarelle; Strathmore one-ply or tracing vellum (100% cotton and translucent) or its equivalent by a different manufacturer, Bienfang 360; rice paper; and Mohawk superfine cover stock, all available at good art supply stores. In the following chapters, especially Chapter 10, Platinum and Palladium Prints, other papers are specifically mentioned for a particular method, but you might try them with other processes as well.

Make sure that the paper you choose will withstand repeated immersion in water. To test it, soak the paper in water for 10 minutes. If the paper fibers rise or separate, the paper will not hold up in these printmaking processes. If you hold rag paper in front of a light, you will notice a watermark, which usually is embedded in the paper with the manufacturer's name and identification of the paper. Use the side of the paper on which the watermark reads correctly. Don't be surprised if a paper you have worked with successfully in the past gives you trouble after you purchase more sheets. Sometimes the manufacturer, without warning, changes the components, such as the internal size, which changes how the paper responds to the photo-printmaking chemicals.

Although many other papers will work, avoid multi-ply papers, which delaminate in liquids, and etching papers, which absorb so much of the emulsion that the chemicals will not wash out where you want them to do so.

MATERIALS AND PROCEDURES *(cont.)*

Note that if you plan to make multiple exposures or to combine processes, you should preshrink paper before printing in order to ensure better negative registration. Preshrinking can be accomplished by the method described in Chapter 8, Gum Bichromate Prints, page 121, or by immersing the paper in a tray of very hot water for 10 minutes. Preshrinking can be combined with the sizing recipe listed in item 4. Hang the paper, without weighting it, to dry.

Catherine Reeve, coauthor of *The New Photography* (see Bibliography), fully describes how to make paper by hand for the photo-printmaking processes. (An abbreviated version appeared in the July/August 1986 issue of *Darkroom Photography* magazine, and both writings include supply sources.) Please note that some paper makers recommend "curing" paper internally sized with Hercon 40 with heat or by letting it sit for 30 days before using it. Reeve does not mention this step. I have observed that papers made from abaca—or abaca mixed with cotton linter—gampi, and kozo do not need sizing, yet they produce impressively rich print colors. You can also buy Japanese Kozo or Hosho paper at a good art store, such as the ones listed in the Supply Sources section at the back of this book.

You might opt for two other printing sheets on which to make Kwik Prints: Kimdura plastic-impregnated sheets (listed in the Supply Sources section of this book), available from Light Impressions (and less expensive than Kwik Print Stable Base Sheets), or Tyvek, a spun plastic that looks a bit like rice paper and is available from Light Impressions, also listed in the back of this book. For a mural, my students and I used Tyvek on a long roll, and we found that Van Dyke brown (see Chapter 7) actually looked black on it, but we could not get cyanotype to work at all.

A method that seems to work well with thin papers is to use nylon screening larger than the sheet of paper underneath the paper before you insert it in the first tray of liquid. With gloved hands you then can easily pick up the screening with the paper on top to move it from tray to tray. This method can be used with other delicate receivers, such as rice paper, caligraphy paper, and vellum.

Fabric can be used with all the processes, both light sensitive and light insensitive. Natural fabrics, such as muslin, cotton, linen, or silk, work best with Polaroid image transfer, cyanotype, Van Dyke brown, gum bichromate, and casein pigment printing. Mercerized cotton, which is cotton that has been specially treated in manufacturing, displays an affinity for photo emulsions and will yield intense color. Synthetics, such as Dacron and cotton blend or acetate bridal satin, available in a wide array of colors, are excellent for Kwik printing. Natural and synthetic fabrics accept magazine transfers and enlargement emulsions. To print multiple coatings and exposures of any process on fabric, make sure that you preshrink fabric in hot water, which also aids in ridding the fabric of the heavy sizes many manufacturers use. These sizes and finishes help protect the fabric but make the fabric unsuitable for photo printmaking because they repel the emulsion. Iron the material flat before starting. An unwrinkled surface makes coating easier and provides for better contact between fabric and negative. When coating many pieces of porous fabric at one time, you can avoid wasting chemicals by stacking pieces so that excess emulsion bleeds through the top piece to the one underneath.

Store finished prints, whether on fabric or paper, in acid-free paper or polypropylene archival storage boxes.

4 Sizing fills the spaces between the fibers in paper pulp or fabric with a water-resistant material, which strengthens the support while it holds the image on the surface, improves definition and tonal separation, and helps prevent staining. Because sizing is time consuming and slightly messy, you may find sizing several sheets at once easiest. You can apply size with a warm damp sponge, sponge brush, or spray bottle or by soaking your support in a tray of sizing solution. Be sure to remove all bubbles and blotches, or they will interfere with the coating of the emulsion. Different sizes can affect the color of the final print, so experiment. I have never found it necessary to size with cyanotypes unless I use a heavy paper such as Rives BFK. *Remember to wear protective gloves and a respirator during the mixing and coating procedures.* Read previous item 3 first.

Type of Size	Methods It Works With
Alum and spray starch	Cyanotype, Van Dyke, gum, casein, platinum, palladium
Gelatin and hardener	Cyanotype, Van Dyke, gum, casein, platinum, palladium
Arrowroot or corn starch	Cyanotype, Van Dyke, gum, casein, platinum, palladium
Polymer medium	Kwik; with gum and casein, combine the alum and spray starch method with the polymer medium method

Alum and spray starch. This recipe, developed by Todd Walker, does not change the appearance of the emulsion or feel of the paper. Spray or pump starch from the grocer and potassium (aluminum potassium sulfate) or ammonium alum from a photo store (or pickling alum from a drugstore) work well to prevent stains with cyanotype, Van Dyke brown, and platinum or palladium printing. I use this recipe first, then use only one layer of the polymer medium (see later in this section) for gum and casein printing.

> For 10 minutes, soak paper in a tray of 1 qt (0.95 L) water mixed with 1 tablespoon alum at 90°F (32°C). Hang or fan dry paper.
>
> Cover paper evenly with one layer of spray starch, sprayed in a horizontal motion. Using a sponge, lightly work starch into paper with horizontal strokes. Hang or fan dry.
>
> Spray vertically and lightly sponge vertically in same way. Hang or fan dry paper.
>
> Soak paper again in tray of plain 70°F (21°C) water for 5 minutes to remove excess alum. Hang to dry.
>
> Before each new color is applied, spray picture with starch and dry. For gum and casein printing, do not respray, but resize with diluted polymer medium as described below.

You can substitute one part liquid starch mixed with one part water for the spray starch. This solution is applied to paper or fabric, but iron the fabric while still damp to set the starch.

Gelatin and hardener. Another method of sizing that retains the suppleness of paper and that preshrinks at the same time utilizes unflavored gelatin, sold in grocery stores.

MATERIALS AND PROCEDURES *(cont.)*

Dissolve four envelopes or 4 tablespoons (28 g) of gelatin into 1 qt (0.95 L) cold water. Let this mixture stand and swell for 10 minutes.

Heat the mixture to 110°F (43°C), but not above 122°F (50°C), then pour it into a clean shallow tray.

Dip both sides of a sheet of paper into the tray for 1 minute, turning the sheet over a few times.

Remove bubbles and squeegee excess size by pulling paper over a towel rod or rounded edge of a tray or by wiping the surplus carefully with a clean brush.

Hang paper, unweighted, in clean area to dry. It will shrink as it dries.

Gelatin solution can be stored and reused for up to a week. To prevent the gelatin from being washed off during processing later, the old recipes called for the size to be hardened in a bath of 7/8 oz (25 ml) formaldehyde with 1 qt (0.95 L) water. However, formaldehyde is so toxic that you cannot purchase it in many places—and I do not recommend its use. Instead, substitute alum hardener (found in photography stores) or a standard 40% solution of glyoxal (see Artcraft Chemicals in the Supply Sources). Make the following solution in a well-ventilated area: Dissolve 1 oz (30 ml) of 40% glyoxal in water to make 1 qt (0.95 L) of solution. Immerse the gelatin-sized and dried paper in a tray of this hardener bath for 5 minutes, rinse in a tray of room-temperature running water for 2 minutes, and hang to dry.

Arrowroot. An old recipe for size combines 2 tsp (1 g) arrowroot (available in the spice section of grocery stores) with 1 c (231.5 ml) water. Boil the mixture to a thick cream for 10 minutes, stirring constantly. Pour it into a tray and use it at room temperature. Or, try 1 Tbsp (14.5 ml) Argo Starch (from the grocery store) mixed with 2 c (473 ml) water. Boil the solution for exactly 3 minutes before using it warm.

As with all recipes, make sure to remove lumps or scum.

Polymer medium. If you are confronted by highlights that do not clear while gum printing or if you want to try Kwik printing on rag paper, the following size will work beautifully. However, it will alter the softness of rag paper and will not allow for any shrinking of the paper after it is applied. This procedure requires you, after each exposure and development of gum or Kwik Print emulsion, to dry the paper and reapply just one layer of this size before adding another coating of emulsion.

Dilute one part white glue, polymer medium, or gesso (found in art stores) with six parts water at room temperature.

Use a wide brush or sponge and coat in horizontal strokes. Then, brush or sponge on another layer using vertical strokes. Air or fan dry paper.

Apply a third coating with diagonal strokes. Air or fan dry.

If you use gesso, it will change the color of the paper slightly; gesso mixed with a little acrylic paint will change the paper to any color you want. Before applying Kwik Print emulsion, sand the gesso on canvas or paper.

5 Applicators. Soft house-painting brushes, which provide for a coating in which the brush stroke can be seen, or polyfoam brushes, which render a

flat, even coating, are available relatively inexpensively at hardware stores. Another option is a latex paint foam roller—or you can make an old-fashioned disposable Blanchard brush, such as those used by the originators of many of these processes. Wrap a length of flannel or cheap velvet around a narrow sheet of glass or the plastic paddle inside a polyfoam brush and secure the fabric with an elastic band near the handle. Flat wood Hake brushes, available at art supply stores, work well, or emulsions can be sprayed on with old atomizer bottles. Platinum Press and Bostick & Sullivan (see Supply Sources) sell a coating tube (The Tube or Puddle Pusher) that facilitates an extremely smooth coating and saves on chemistry. Sullivan suggests that to use a coating rod, you set up on a flat surface such as a piece of plate glass with sanded edges. Next, add a couple of sheets of newsprint to provide a slight cushion, then lay down the piece of paper to be coated. Remember, though, that applicators should be washed after each work session, and applicators for one process should not be contaminated with chemicals from other processes.

Paper can be floated on one side in a tray of emulsion. To conserve the emulsion, pour a small amount of it in a glass or porcelain tray and prop the tray at a 45° angle while dipping the paper.

6 Trays. Nonmetallic trays larger than the dimensions of the support are recommended. Photographic trays, dish pans from the hardware store, large plastic bussing tubs purchased through restaurant equipment suppliers, or glass baking pans from flea markets work well.

7 Contact printing frame. Buy one or build one, as described starting on page 43. Make sure that the glass is clean before each use.

8 Light source. With the exception of enlargement emulsions (Chapter 12) and bromoil and chromoskedasic printing (Chapter 11), photo-printmaking techniques need ultraviolet light for making the exposures. Detailed explanations of ultraviolet sources were provided earlier in this chapter. Avoid carbon arc lamps, since they emit imperceptible gases that are extremely toxic when inhaled.

9 Brown bottles. Recycled 1 qt (0.95 L) brown fruit juice bottles with tops, thoroughly washed, make excellent storage containers for the light-sensitive emulsions. Washed out empty beer bottles can also be used: discard the metal screw top, and buy plastic caps at a pharmacy or liquor store. Or you can buy brown bottles at a photography store or drugstore. Stay away from plastic, however, which tends to absorb the liquid chemicals. Label each bottle with a permanent marker as to contents, date mixed, and safety precautions.

10 Washer. Most prints need to be washed. You can use a siphon washer, available at photography stores, or you can drill holes near the top of the sides of a tub or tray and place a hose with running water near the bottom. Both methods allow clean water to enter while contaminated water drains. You may want to purchase a photographic sponge to blot excess water from the print after the final wash. Avoid rubber squeegees, which often shred the paper.

11 Water. Use distilled water for mixing the emulsions; usually tap water suffices for washing prints. However, when I was in Guatemala, I noticed my prints dried lighter and deduced that the tap water there contains a lot of chlorine. So, I washed my prints in bottled water.

MATERIALS AND PROCEDURES *(cont.)*

12 Plexiglas. A sheet of plastic or the smooth, clean back of a tray angled in the sink helps process the emulsions that call for a running-water development. The plastic is first wetted, the paper is stuck to it, and water is sprayed on the print. The unused emulsion drips down and off the print. Nylon screening stretched over a wooden frame that fits inside your trays helps prevent delicate papers from ripping when you pick up the paper during processing.

13 Fan. Air drying is the fastest and safest way to dry sizings, emulsion, and printed images. Try a fan or a hair dryer on a cool setting applied to both sides of the support (heat can destroy the emulsion and accidentally shrink paper and fabric).

Often when I am working, either sizing or coating paper, I hang up the sheets to dry. To avoid contamination from different processes, I have found that using a plastic-coated clothesline that can be easily cleaned and plastic clothespins that are color coded to different processes makes my job a lot easier.

Tips

■ If your tap water contains contaminants, use distilled water to make sizes and emulsion and to wash the print. Fill the wash tray with clean water after discarding used water every 5 minutes for an hour.

■ A stack of unfolded newspapers on the coating area prevents contamination. As you coat, strip off the top layer of newspaper when it absorbs emulsion. Or cover the work area with oil cloth (available from the Vermont Country Store; see Supply Sources), which you must regularly wipe clean.

■ Wash mixing utensils thoroughly after contact with each chemical.

■ By lightly drawing around your negative with a pencil on paper, you can indicate where to coat. Coat beyond the image area or coat an extra swatch of paper in order to watch the change in color during the exposure of cyanotypes and Van Dyke brown prints.

■ Your negatives can be damaged if they come in contact with wet chemistry, so make sure that coated emulsion is *absolutely dry*. Use a fan or a hair dryer on a cool setting; air dry flat or hang the coated paper or fabric to create drip patterns. If you hang the coated piece on a clothesline with clothespins, wash the line and pins before the next use to prevent stains on future paper or fabric.

■ If you are using plants or other living matter under glass as your negative, place a sheet of clear cellophane or plastic wrap from a grocery store on top of the emulsion and under the plants. They sweat as they heat up under ultraviolet light, and the liquid produced can stain the print. If you do not place plants under glass, they will not sweat, and you can expose them atop *wet* emulsion. The exposures are much faster, but the plants may be ruined by the emulsion.

■ Tall objects can be placed on top of the glass during an exposure. They can cast shadows.

■ Do not take a coating brush into sunlight or leave the brush sitting around—chemicals left on the bristles will be exposed, ruining the next coating. Wash and carefully dry the brush after each use.

■ Exposure times vary. The level of sunlight, time of the year, and time of day affect the exposures. With artificial ultraviolet light, the age of the bulb and its distance from the emulsion alter the exposures. Dust on bulbs can cause longer exposures.

■ Double exposures can be produced by moving the negatives halfway through the exposure.

■ Do not develop the print in bright sunlight: You risk overexposing the print from further contact with ultraviolet light.

■ Cold-water procion dyes, embroidery thread, and appliqué offer additional possibilities on a fabric print. Oil and watercolor paints, pencils, and markers can extend the design of a print on paper.

■ Keep a small hand towel near you. I throw one over my shoulder while I work.

■ A dry mount press is helpful for flattening your prints. Or, use an iron set for cotton on the back of rag paper. The heat often darkens the emulsion. I advise against dry mounting your prints; you can photo-corner them or hinge them onto a backing.

Safety

Completely read each chapter's directions before starting.

Always read and follow manufacturers' warning labels.

Most of the chemicals are poisonous. Store them beyond the reach of children.

When mixing powder chemicals, wear a respirator containing a dust and mist filter, available at hardware stores. For black-and-white photochemistry, use a respirator with a combination acid gas and organic vapor cartridge, such as ones made by 3M or North. Mix chemicals in a well-ventilated area. Details on health and safety precautions are found near the end of the introduction to this book, and suppliers are located in the back of the book.

Mix and coat chemicals in a well-ventilated area to avoid inhaling fumes and particles. Wear protective gloves to avoid skin contact.

Never mix ammonia or ammoniated products with chlorine bleach—you will create deadly fumes. Wear a respirator mask when handling ammonia.

Add acids to water, but never water to acids.

Do not store, prepare, or eat food near chemicals, ink, or solvents.

Do not use mixing utensils for other purposes. Thoroughly wash utensils after contact with each chemical.

Never look directly into the exposure light. You can purchase special ultraviolet-protective goggles at a laboratory safety supplier. Avoid carbon arc lamps, since they emit imperceptible gases that are extremely toxic when inhaled

Chapter 5 MAKING NEGATIVES

Most techniques described in this book require a negative transparency to be made and placed in contact with a light-sensitive coating; that combination is then exposed to light. The negative is removed, and the exposed emulsion is processed, yielding a final positive image the same size as the negative. Negatives from your hand-held camera used in this way probably will make an image too small for your needs.

There are two ways to generate large negatives: using photographic darkroom methods or using nonphotographic methods, such as drawing on acetate. These two types of negatives can be used alone or in combination with each other. The negatives can be used repeatedly, and they can be moved during the exposure to create double exposures.

WITH A DARKROOM

If you use a darkroom, you can make a negative with an enlarger, with a graphic arts process camera, with an enlarger converted into a process camera, or with black-and-white photographs. The first half of this chapter describes these methods.

Photography is based on light hitting a light-sensitive coating called the *emulsion,* which usually is made of silver particles commonly referred to as the *grain.* The emulsion on film used in hand-held cameras is *panchromatic;* that is, it is sensitive to all (*pan*) visible spectra of light (*chroma*). The film this chapter describes, for use in a darkroom, is *orthochromatic* because it is not sensitive to red light, such as the red safelight in a darkroom. (Black-and-white photographic paper is orthochromatic also.) One major quality distinguishes types of orthochromatic film, namely, whether the film *reverses* or *duplicates* the image being projected on it. This chapter concentrates on film that reverses from a negative image to an enlarged positive transparency or from positive to negative, because it is easier to find such film on the market. A less detailed description of duplicating film is given. Duplicating film repeats the same tones as the image projected on it. (You get an enlarged negative from a camera negative, or an enlarged positive from a slide.)

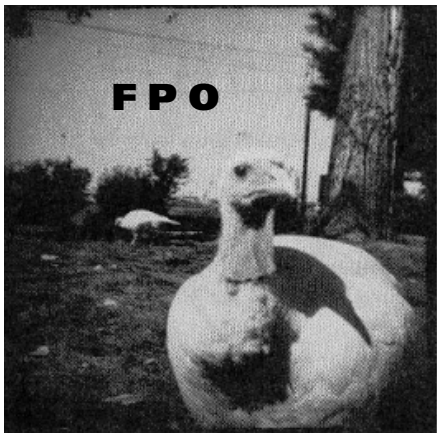
Orthochromatic film can be bought in standard-size sheets, such as 8×10 in. (20.5×25.5 cm), 16×20 in. (40.5×50.75 cm), and so on. There are many types of orthochromatic (or *ortho*) film, known as *graphic arts* film or *lith* film, but the discussion in this book is limited to a few specific brands, listed in the chart that follows.

Graphic Arts Films and Their Properties

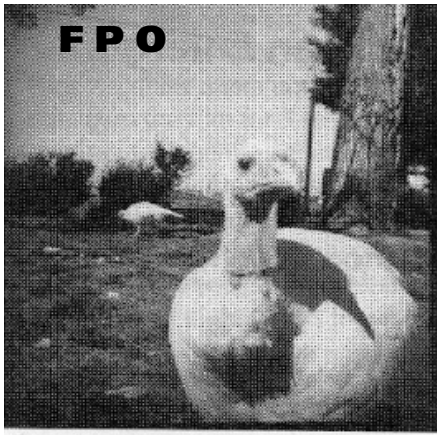
Type	Properties	Start with
Kodak Kodalith Ortho Film Type 3 or Type 4127 (4 × 5 in. and 8 × 10 in. sizes only) Ilford Commercial Ortho Film Fuji Fujilith HCS/HCO Arista APH Agfa N31p	High-contrast or continuous-tone results, depending on chemical developer used (see illustrations below). Always reverses from positive to negative or from negative to positive.	Halftone negative, continuous-tone negative, or high-contrast negative, which yields an enlarged positive. Positive is contacted on another sheet of reversal film to make a negative. *or* Continuous-tone positive (e.g., slide), which yields an enlarged negative.
Kodak Precision Line LPD4 or SO-132 (4 × 5 in. and 8 × 10 in. sizes only) Agfa S D 610 Duplicating Film Fuji Fujilith High Speed Duplicating Film DO (hard to find) WPS Hi Speed Duplicating Film	High-contrast or continuous-tone results, depending on chemical developer used (see illustration below). Always duplicates from negative to negative or from positive to positive.	Continuous-tone negative or high-contrast negative, which yields an enlarged negative.

Expanded from Bea Nettles, *Breaking the Rules: A Photo Media Cookbook*. Urbana, IL: Inky Press, 1977.

High-contrast image.



Continuous-tone image.



Halftone image.

Note: Because a printing press cannot reproduce a continuous-tone image, this is a halftone approximation. A continuous-tone image is similar to a conventional black-and-white photograph.

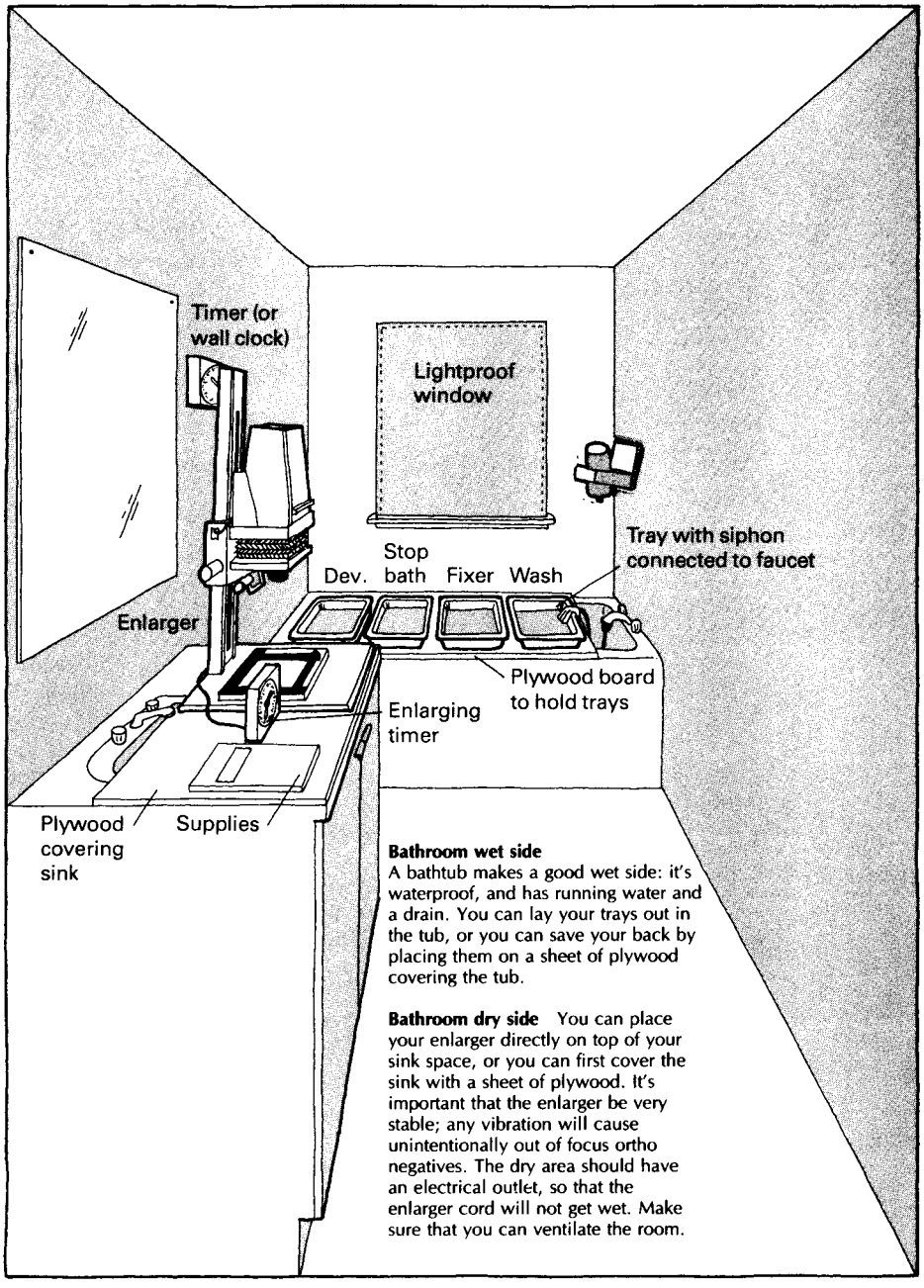
Developers and Their Properties with Orthochromatic Films

Type	Start with	Dilution with water and development times	Special remarks
Paper developers Sprint Print Ilford Universal Solutec D-72 Kodak Dektol	 Liquid in bottle Liquid in bottle Liquid in bottle Stock solution made from powder	 Usually three times as dilute as manufacturer recommends. Less dilute = more contrast. More dilute = less contrast. 2¼ minutes.	 Tends to produce transparencies that look like black-and-white photos (slightly contrasty). Dektol seems to be the most reliable.
Film developers Kodak D-76 Agfa Rodinol Lith A and B (available from many companies)	 Stock solution from powder Liquid in bottle Can be liquid or stock solution made from powder	 Straight or 1:1; 5–7 minutes. 1:25; 2–5 minutes. Mix equal parts A and B solutions; 2½ minutes.	 Tends to be very continuous tone. Punchy, but hard, fine grain. Very contrasty (eliminates middle tones).

Setting Up a Darkroom

Often, a bathroom makes the best location for a darkroom. It has the necessary plumbing and waterproof surfaces, and easily can be made lightproof.

A few innovations make even a small closet darkroom feasible. Wall-mount your timer and safelight, or screw a safelight into the ceiling fixture. Use a tray rack to stack your trays, and keep a bucket nearby to hold fixed negatives that will be washed elsewhere.



How Dark Does It Have to Be?

When lightproofing doors and windows, weather stripping (found in hardware stores) works well. You will find it almost impossible to block out every bit of light. Small cracks of light, unless they are right next to where you are enlarging or processing ortho film, often will not hurt your film; if you have any doubts, however, print only at night. You can test to see whether your film is not safe by doing the coin test described on page xi. Black 4 ml polyethylene, available at hardware stores as a cover for gardener's mulch, works well as a window cover.

Safety

Store all chemicals safely in brown jugs or plastic-lined cube containers, out of the reach of children.

Keep your darkroom well ventilated at all times and wear a respirator with a toxic dust filter when mixing dry chemicals. Avoid skin contact by using protective gloves, and do not allow chemicals to splash in your face. Wear protective goggles.

Developers are highly toxic by ingestion and inhalation. Concentrated stop bath can cause burns and irritation of the breathing passages and throat. Fixer and stop bath combined can produce a gas that is corrosive to the lungs. Old fixer solution produces toxic gas, so discard fixer that is not clear in color.

Be careful with electrical cords and appliances; nothing electrical should be within arm's length of a sink. You will move more safely in your darkroom if you maintain safelights at the maximum brightness that your materials will permit, as suggested by the manufacturer.

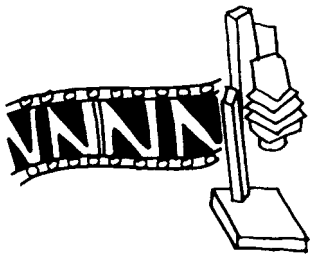
Read the manufacturer's warning labels before you use each chemical. When cleaning up, dump each tray of chemicals down the drain with plenty of water, disposing of them in the reverse order of how you used them.

Using an Enlarger

This section describes how to use a conventional darkroom equipped with an enlarger to make graphic arts negatives for photo-printmaking processes.

Method Overview

1 Your negative, placed in a photography enlarger, is projected onto orthochromatic film.



Using an Enlarger *(cont.)*

2 The orthochromatic film is developed to produce a positive transparency. The dry positive is placed on top of a fresh sheet of orthochromatic film and exposed to light.

3 The fresh sheet is developed, producing a negative transparency.

Materials

1 Image. Use your own black-and-white shot negative in your own camera, or use semitransparent objects such as flower petals and leaves. Your camera-made negative partly determines whether the print will be high contrast (consisting of highlights and shadows) or continuous tone (with many middle tones). Color negatives and slides require more maneuvering.

Traditional photo printmakers use large-format cameras to get 4 × 5 in. (10 × 12.7 cm) or larger negatives, thus eliminating the enlarging process. Many platinum printers rave about Pyro Developer (see *The Book of Pyro,* by Gordon Hutchings, listed in the Bibliography) for developing these large-format negatives.

2 Orthochromatic film can be purchased from graphic arts or photographic suppliers or from printing suppliers. Although most manufacturers package 100-sheet boxes only, Ilford makes 25-sheet boxes of Technical Film Ortho. I use Freestyle Camera (formerly known as Freestyle Sales) to buy small quantities of Arista and N31p. William Paul will ship their reasonably priced WPS Duplicating Film, but I have found

that duplicating films are inherently higher contrast. If you cannot locate what you want, write to the manufacturer (addresses are listed in the back of this book) or call an offset lithography printer. Film should be stored in a cool, dry place. It comes in standard sizes, such as 8 × 10 in. (20.25 × 25.5 cm), 11 × 14 in. (28 × 35.5 cm), and so on. You can special-order Kodak ortho glass plates, which you handle like ortho film.

Judy Siegel, editor of the wonderfully informative *World Journal of Post Factory Photography,* suggests purchasing rubber fingertips ("the kind used for counting stacks of money") at a stationery store if you are having trouble removing one sheet of film at a time from its package.

3 Photo chemicals needed include lith developer for high-contrast and halftone results, or photographic paper or film developer for continuous-tone results; stop bath; fixer; clearing agent; and wetting agent. All of these are available at photography stores.

Developer. Light is projected onto the photographic emulsion and a latent (invisible) image is formed on the orthochromatic film in the darkroom. When the exposed film is immersed in the developer, the latent image becomes visible. Lith developer in powder form can be purchased in sets of two premeasured packages, each package making 1 gallon of stock solution A and 1 gallon of stock solution B. Photographic paper developer, such as Sprint Print, Ilford Universal Print Developer, or Solutec D-72 Developer (which is like Dektol), can be bought in small liquid quantities. Although you should use liquid rather than powder chemicals when possible to avoid the risk to your health of breathing in the powder, you can instead wear an acid gas or organic vapor mask when you mix the powdered Kodak Dektol.

If you are making a negative to use with photographic printmaking techniques, use the developer three times as diluted as the manufacturer recommends, except for Ilford Universal Developer and Kodak D-76 (they work diluted as the manufacturers recommend). For brown prints, I prefer negatives developed in D-76 straight or diluted with an equal amount of water to make a less contrasty image. I develop the film for 5 to 7 minutes in a tray with gentle agitation. For blue and gum prints, I use Dektol as described in this chapter. Diluted developer is dumped after a darkroom session, but stock developer has a shelf life of 8 weeks in a stoppered brown bottle.

Stop bath. Even after film is removed from the developer, the chemicals absorbed into the gelatin emulsion continue to function and the image continues to build up, increasing both the density (thickness) of film and the contrast (lack of middle tones) of image. To avoid these problems, immerse the film in a *weak* acid stop bath—bottled by most photographic companies as 28% acetic acid *indicator* shortstop, which is a stock solution. It has an almost indefinite shelf life in a stoppered bottle and, once diluted, will turn purple when it is no longer usable.

Fixer. Although the film is temporarily stable in the stop bath, the image is not permanent. The fixing bath (or *hypo*) makes the emulsion impervious to white light, and it washes off unused silver crystals. Most photography companies make a liquid hardening rapid fixer, which helps prevent the emulsion from softening or scratching easily. Follow the manufacturer's recommendation for mixing film-strength (not paper-strength) fixer. Fixer can be saved after a darkroom session and later reused. A bottle of Hypochek™ by Edwal is a good investment, because one drop squirted in the fixer will tell you whether the fixer is still usable.

Clearing agent. Fixer can cause fading or discoloring of the image if it is not washed out of the film. An efficient method to rid the emulsion of fixer—rather than washing for hours in water—is to use one of the commercially available hypo eliminators, such as Heico Perma-Wash or Kodak Fixer Remover. Follow the manufacturer's instructions for film clearing.

Wetting agent. Kodak's Photo Flo or any other wetting agent removes dirt and other particles from the film's surface and promotes the static-free drying of the film (and therefore makes the film less dust-attracting). Dilute as the manufacturer recommends.

4 A darkroom with an enlarger. Film is sensitive to white light until it has been bathed in the fixer, so you will need access to a darkroom outfitted with a red safelight, such as Kodak Red 1A. Because the photo chemicals are not healthy to breathe, the darkroom should have a good ventilating fan.

An enlarger with appropriate lens (50 mm lens for 35 mm camera negatives) projects light through the camera negative onto orthochromatic sheet film to make enlargements. The enlarger should include a negative carrier, which is a device for holding the camera negative in place in the enlarger. The rectilinear opening in the negative carrier has to be large enough to accommodate the size of your negative. Glass negative carriers are useful for projecting flower petals or other semitransparent objects.

Most enlargers are the condenser type, which can emit light that is too contrasty for many of the photo-printmaking processes. Either use a cold-head enlarger or insert a sheet of frosted Mylar™ near the condenser to diffuse the light. Plan on needing more light for the exposure.

5 One-gallon brown storage bottles for storing diluted photo chemicals.

Using an Enlarger *(cont.)*

You will need one bottle for either print or film developer (or two bottles if you are using lith developer), one bottle for the stop bath, one for the fixer, and one for the fixer remover. Bottles may be purchased at photography stores or donated by your pharmacist, or you can recycle juice bottles. The bottles should be labeled as to contents and date mixed.

6 Stirring rod or stainless steel iced tea spoon for mixing chemicals with water. Do not use a rod that can chip or break; I use plastic dinnerware, found at the grocery store.

7 Funnel for pouring chemicals into storage bottles.

8 Photo trays or plastic dish tubs. At least three trays, slightly larger than the size of the film you are processing, are needed. To avoid contamination, mark each one with a laundry-marker pen: *developer, stop, fixer.* You may want a fourth tray for the fixer remover, a fifth for the water wash, and a sixth tray for the wetting agent bath. If the developer tray is white and you keep it clean, you will more easily see if the developer has gone bad and turned brown during your darkroom sessions. Some photographers have taken to using a Jobo print processor, available at a photography store, or a BTZS tube (available from The View Camera Store, formerly known as Darkroom Innovations) to process their enlarged negatives because it saves on chemistry and can be used safely.

9 Timer, such as a GraLab timer, or a clock with a sweep second hand, is needed to time the steps when processing film. The timer should range from 1 second to 60 minutes.

10 Enlarger timer with a range from 1 second to 1 minute or more is needed to control the exposure times.

11 Photographic thermometer showing at least 50–125°F (10–50°C) is used when adjusting water and chemical temperatures during film processing. All photo chemicals should be used at around 68°F (20°C), unless the manufacturer recommends otherwise. If developer goes below 65°F (18°C) or over 75°F (24°C), it will not work properly. Just remember my sad story: when I was in grad school, I printed in an unheated darkroom, wearing a ski parka, in the cold of a Rochester, New York, winter. Nothing came out no matter how long I exposed. In frustration, after wasting many sheets of film, I called a friend, who told me to bring a space heater into the room and place the developer tray in a larger tray of hot water. . . . It worked!

12 Graduate or measuring cup is needed to measure and dilute chemicals for use. The most useful size is 32 oz (946 ml) with 1 oz (30 ml) increment markings.

13 Photography easel to hold the sheet film flat. Those with movable blades can crop the image projected on your film—a feature you may find practical—or you can use a clean, scratch-free piece of plate glass that is larger than the sheet of film.

14 Plate glass or contact printing frame a little larger than the sheet film size is essential when you reverse the enlarged positive to an enlarged negative for all photo-print-making processes in this book. The glass must be absolutely clean and free of scratches; you may want to cushion it on a flat rubber mat, and definitely sand the edges to prevent it from cutting your hands.

15 Print tongs, available at photography stores, are used to move the ortho film from one tray to the next; you must use different tongs in each tray of chemical solution. Label the tongs according to which chemical they touch, but do not put your hands in the chemicals at any time. Tongs are one of the least expensive items, so buy good ones that are easy to manipulate, such as the wishbone-shaped plastic tongs with rubber tips made by Cesco Lite. Metal tongs scratch the film.

Judy Siegel, frustrated by most tongs as inadequate to do the job with sheet film, recommends "The Squibb," made by "pulling the bristles out of an old toothbrush with a pliers, sanding the surface, and epoxying a tiny film clip onto it." She says that you can use the clip found on the back of convention badges, too. Do not clip into the image area, but allow a ½ in. border on the film. Wash the clips carefully after each use. Author and columnist David Vestal glued wooden clothespins, which do not rust, onto a strip of wood. I find plastic clothespins easier to wash of contaminants.

16 Siphon print washer or tray with holes punctured in the sides aids in washing sheets of film. If you do not have a sink large enough to accommodate all the chemicals, place the trays on newspaper in case of spillage. The washing step needs to go on in a sink or bathtub. I have seen some photographers fill a tray with water, shuffle the negatives, empty the tray, and fill it up again with water. This procedure should be done for at least ten changes, but

you must be extremely careful not to scratch the film, which is fragile when wet.

17 Anti-stat brush removes dust from camera negatives and the enlarging lens without scratching them. It is available at photography stores. To protect our environment, I am not recommending canned air with freon and other gases.

18 Grain magnifier is a device that is placed on the easel to ensure accurate focusing of the image.

19 Loupe or magnifying glass is helpful when examining the quality of your finished ortho negative, and it is a necessity for viewing halftones. An 8× loupe can be purchased at photography or graphic art supply stores, and you can find an even stronger 12× loupe at silkscreen supply stores.

20 Scissors are needed to cut film test strips in the darkroom.

21 Masking tape comes in handy for labeling chemicals, holding steady test strips of sheet film, and other purposes.

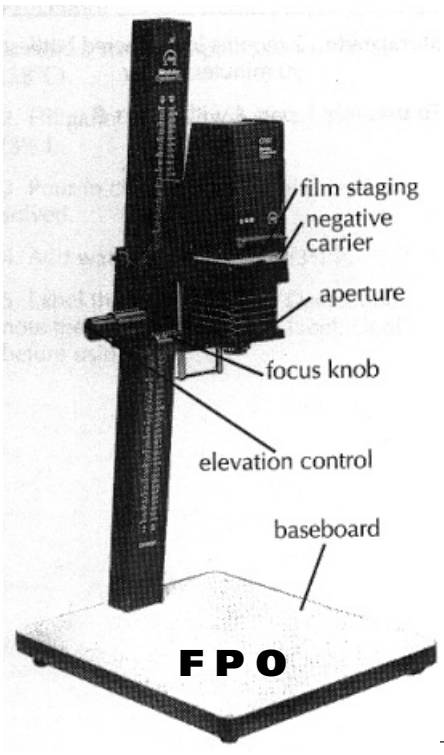
22 Record sheet for writing notes on exposure details is helpful. You can set up your own sheet, so bring a black pen or pencil into the darkroom with you. Jot down what you are doing (e.g., continuous-tone positive), what kind of ortho film and developer you are using, the size of the enlargement you are making, the f/stop and time, the duration of the exposure, and your evaluation of the outcome (e.g., "too dense"). The information you accumulate will give you a starting point for future darkroom sessions.

23 Flashlight. Some people use a small penlight flashlight for reading the f/stop numbers on the enlarger lens in a darkroom, but more experienced photographers learn to count the clicks that indicate the aperture openings. A flashlight also can be used instead of an enlarger light to expose film and create unusual drawings on film.

24 Opaque gray cardboard is needed to block light from the enlarger while exposing film for the test strip. Try using a piece of 11 × 14 in. (28 × 35.5 cm) cardboard with 8 × 10 in. (20.25 × 25.5 cm) sheet film. By puncturing a hole approximately the diameter of a pencil in the center of the cardboard, you can also use it as a burning tool (see Tips, page 77). A wire attached to a cardboard circle can be a dodging tool (see page 76).

25 Glass cleaner, paper towels, hand towel, lens tissue, and protective gloves are all helpful in a darkroom. Clothespins and string, hung in a dust-free location, even a cardboard carton, make a drying system for negatives. For storing dry negatives, I use see-through print sleeves from an art store or glassine envelopes (from stamps purchased at the post office), which I put inside an empty photo paper box.

How the Enlarger Works



Your enlarger and enlarger lens represent the largest investment you will make in your darkroom and should be purchased only after considering your present and future needs. Some enlargers can be used only for 35 mm camera negatives; others can also be used with larger negatives. Most enlarger models can be adapted to make color photographs, although no process in this book necessitates color capacity. When you are first starting, you could rent a darkroom space and take this book with you in order to find out what you will need for your own darkroom.

The *film staging* opens so you can remove and insert the loaded negative carrier.

The *negative carrier* isolates the chosen camera negative from the negative strip, holds it flat, and centers it under the enlarger light source.

The *aperture* on the lens controls the amount of light that will project onto the ortho sheet film. The lightness (thinness or transparency) and the darkness (density or relative opacity) of the ortho negative are controlled by the amount of light that strikes the film's emulsion. The *lens* itself directs that light.

The *focus knob* adjusts the sharpness of the projected image. It does so by changing the distance between the camera negative and the lens.

The *elevation control* changes the projected image size by changing the distance between the enlarger lens and the baseboard.

The *baseboard* provides a stable foundation for the enlarger and a place to put the ortho film when making enlargements.

Using an Enlarger *(cont.)*

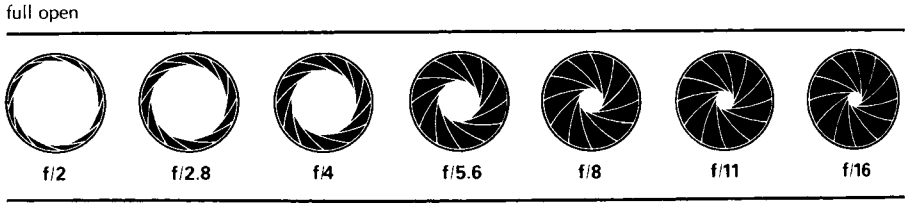
By plugging the enlarger cord into a special outlet on the *timer,* you can calibrate the timer's enlarger button and focus switch to turn on the enlarger light. The timer's cord must be plugged into an electrical socket.

timer

The Enlarging Lens

The lens on an enlarger works just like the one on a camera. The lens aperture ring controls the amount of light that will reach the film through the enlarger by changing the size of the aperture opening. This ring is marked in f/stop numbers, each of which is in a relationship of 1:2. For instance, f/8 allows twice as much light as f/11 and four times as much light as f/16. Conversely, f/5.6 allows half as much light as f/4 and one-fourth as much light as f/2.8. This progression can help when you are trying to determine the proper exposure for making enlarged negatives in the darkroom. If your negative is twice as dark as you want, you merely stop down one f/stop.

Make sure that the lens you use is intended for your camera negative size: a 35 mm negative needs a 50 mm lens, a 2¼ in. (5.7 cm) negative requires an 80 mm lens, and a 4 × 5 in. (10 × 12.5 cm) camera negative uses a 135 mm lens.



Making the Stock Solutions Step by Step

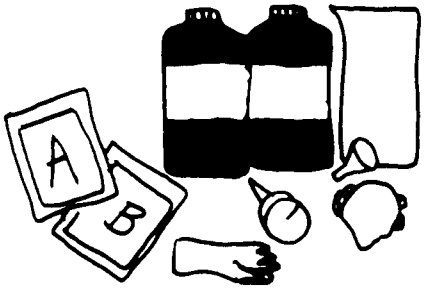
A stock solution is the main concentrate of liquid chemistry from which working mixtures are made.

Making the Stock Solution

High-Contrast Film Developer

Equipment You Will Need

Kodalith A and B to make 2 gal (7.5 L)
Two 1-gallon storage bottles
Graduate
Thermometer
Funnel
Label
Respirator with toxic dust filter
Neoprene gloves



Storage life: 2 months in stoppered bottles

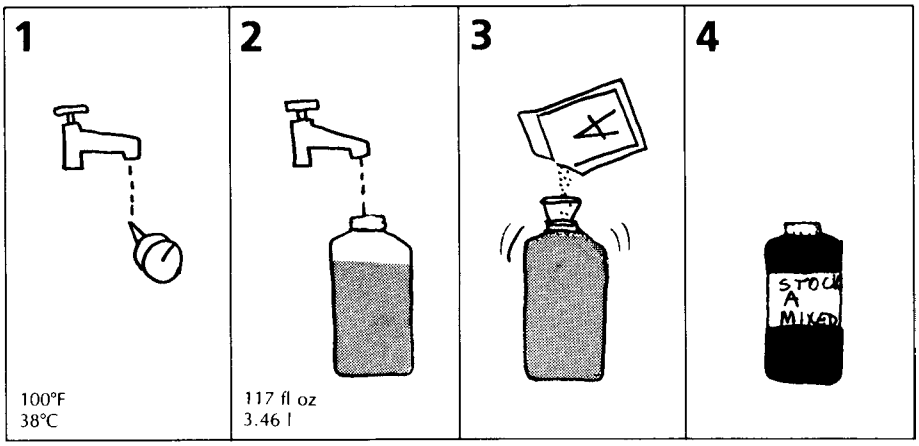
60–90 minutes in tray (depending on how many sheets of film are put through it)

To use: Mix 1 part A with 1 part B

Making the Stock Solution *(cont.)*

Procedure
[figure 5-14]

1. Adjust water temperature to 100°F (38°C).
2. Fill storage bottle with water to 3½ qts (3.3 L).
3. Slowly pour in powder chemical from packet A and shake until dissolved.
4. Label this *stock lith A* and note the date mixed on label.
5. Repeat this procedure, using clean implements, to make 1 gal (3.75 L) of stock solution B. Cool before using.



Making the Stock Solution

Continuous-Tone Paper Developer

Storage life: 6 months in full bottle
2 months in half-full bottle
approx. 2 hours in tray (depending on how many sheets of film are put through it)

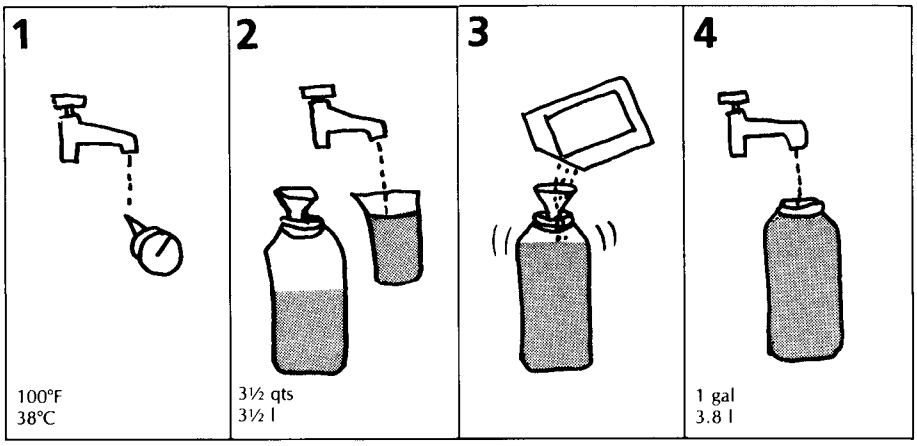
To use: Mix 1 part Dektol with no more than 10 parts water. Do not overdilute or developer will exhaust too easily.

Equipment You Will Need

Kodak Dektol to make 1 gal (3.75 L)
Gallon storage bottle
Graduate
Thermometer
Funnel
Label
Respirator with toxic dust filter
Neoprene gloves

Procedure

1. Adjust water temperature to 100°F (38°C).
2. Fill gallon jug with water to 3½ qts (3.3 L).
3. Pour in chemical and shake until dissolved.
4. Add water to make 1 gal (3.75 L).
5. Label this *stock solution Dektol* and note the date mixed on the label. Cool before using.



Making the Negative

This section describes enlarging your 35 mm camera negative to produce a print-size positive with full tonal range on reversal orthochromatic film, such as Kodalith. The positive is then contact printed onto another sheet of ortho film to produce a negative. Please note from the chart on page 63 that these directions can be adapted. If you are starting with a slide that is a positive rather than a negative, you can eliminate many steps because when you project the slide onto lith film you will automatically create a negative. Or, if you have a negative and enlarge onto orthochromatic duplicating film, such as Kodak's LPD4, you will create an enlarged negative directly, thereby eliminating many steps. All photo-printmaking processes in this section of the book (except bromoil, chromoskedasic painting, and enlargement emulsions) require an enlarged negative to produce a positive print.

Making the Test Strip

Finding the best exposure time required for ideal image density is essentially a process of trial and error, but a test strip makes the search easier and less expensive. A test strip is made by exposing successive portions of a small piece of ortho film for different lengths of time. With reversal film, such as Kodalith, strips exposed for short periods of time will be thinner (more transparent) than those exposed for a longer time. However, with duplicating film, such as Kodak LPD4, the strips exposed for short periods will be denser (less transparent) than those exposed for a longer time.

Finding the Emulsion Side

Open the box of film only in the dark or under the appropriate red safelight. Once you have broken the seal, you will find the sheets of film in an inner wrapping of black plastic or black paper that protects the film from accidental exposure to light. Carefully remove one sheet of film, close the wrapper, and put the package back in the box. Ortho film has a light side and a dark side, which you can discern under the safelight. The light side is the emulsion, and it should be placed face up under the enlarger.

Camera negatives tend to curve toward the emulsion side, which is somewhat duller than the nonemulsion side. When enlarging onto lith film, place camera negatives or positives emulsion side down in the negative carrier and shiny side up. When using duplicating film under the enlarger, place negatives emulsion side up in the negative carrier.

Tips

■ Developer should be kept at 68°F (20°C). If the developer is much too cold, it either will not work or will work slowly. If the developer is too hot, film will blacken too quickly or film will develop unevenly. To cool a chemical once it is in the tray, put ice cubes in a metal or glass beaker or Ziplock™ bag and place the beaker or bag in the solution to be cooled. If the temperature is too low, place a similar container of hot water in the tray; stir the developer with your tongs to even the solution temperature.

■ Other chemicals should be kept at 65–75°F (18–24°C).

■ Dektol 1:1 produces higher-contrast transparencies, whereas Dektol 1:9 yields lower contrast. Usually I use Dektol at a solution of 1 part Dektol to 6 parts water.

■ Many platinum printers recommend the combination of Agfa N31p film, readily available from Freestyle Camera, with Kodak HC-110 developer at dilution B. Unless you have a drum or tube processor (see item 8 in this chapter's Materials list), you might find HC-110 frustrating to work with. It has very little capacity; that is, you either have to dump it or use HC-110 replenisher after each sheet of film. Following a few sheets, the results start to change even with replenisher. Repeatedly dumping a whole tray of developer can get costly to the budget and the environment, whereas drum and tube processors require significantly less chemicals and a development time of 4 minutes.

■ Try Agfa's Rodinol film developer, diluted 1:25 parts water, for a slightly grainy continuous-tone negative with punch. Develop for 2 min 15 sec for starters. If you are not satisfied with highlight detail, try developing for 4 minutes. Whatever time you decide on, keep it constant with succeeding film. Rodinol is especially effective with duplicating film, but it has a short tray life.

■ A few custom photography labs will make enlarged continuous-tone negatives from your camera negatives or slides. Many copy centers can make enlarged continuous-tone or high-contrast negatives from flat art. Some commercial companies will make digitally enlarged negatives geared to photoprintmaking processes from your transparencies, computer files, or flat art.

How Should the Strip Appear?

Select the best exposure time based on density, contrast, and grain, and note the pertinent information on a record sheet. The length of the exposure and the f/stop determine the density. With lith film, the more light that hits the film the denser the film becomes, whether you are making a negative or a positive. If the bands are too black, close down 1 f/stop to f/11. Conversely, the less light that reaches lith film the more transparent it becomes. If all the bands are too clear, open up the aperture 1 f/stop to f/5.6. (With duplicating film, more light makes a more transparent test strip, and less light makes it denser.)

Look for a section with some detail in the shadows and the highlights, if you have used a continuous-tone developer.

Diluting lith A and B developer other than as the manufacturer recommends is not advised. Rich blacks with no middle tones should appear if you have used A and B developer properly.

With a loupe, inspect the positive, preferably on a light table. Make sure the grain is in focus, even if the image is intentionally out of focus. For platinum or palladium printing, you will probably want a positive that looks flat with no absolutely clear area. You can obtain flat results by overexposing and strictly timing the very dilute developer.

See the print on p. 76.

Tips

■ When using Dektol, keep the development time at 2 min 15 sec, the temperature at 68°F, and the agitation gentle, no matter what results you obtain. Change the exposure for more or less density or change the developer dilution to manipulate the contrast.

Setting Up the Dry Side

1

Preparing the equipment

You will need an enlarger, timer, negative carrier, easel, negatives, cardboard, grain focuser, lens tissue, anti-stat brush, pen, record sheet, and scissors. Adjust easel blades to the size of the film, or carefully clean both sides of glass.

Place the negative in the negative carrier with the image upside down and emulsion down. Clean both sides of the negative with the anti-stat dusting brush. Insert loaded negative carrier into the enlarger.

2

Preparing the enlarger

Turn the enlarger's focusing light on and twist the lens aperture all the way open to give the brightest possible image. Use the enlarger's elevation control to raise or lower the head. This will change the general image size to match your sheet film size. Make the image a little smaller than the film size so that you will have a border, which aids in development by allowing a place for your tongs to touch the film without hurting the film emulsion.

3

Focusing the image

Clean the enlarger lens with lens tissue. Using the grain focuser, look at the image while you move the focusing knob until the image looks as sharp as you want. Lock the enlarger. Center the easel under the enlarger and adjust the easel blades to the edge of the image.

You can raise or lower the head of the easel and refocus until the projected image is the size you want. Change the lens aperture to f/8 (or f/5.6 for duplicating film) and turn off the enlarger.

Setting Up the Wet Side

4

Preparing the chemicals

You will need developer, stop bath, fixer, four clean trays and three clean tongs, wash tray, graduate, thermometer, and stirring rod. Wait to mix developer because it has a limited tray life.

For 8 × 10 in. trays, pour into stop bath tray 20 oz (583 ml) of working-strength stop bath for 8 × 10 in. (20.25 × 25.5 cm) film. The point is to fill the tray with enough liquid that the piece of film easily will be covered by the diluted chemical.

Pour into fixer tray 20 oz of working-strength film fixer, and pour 20 oz fixer remover into another tray.

5

Setting up the wash tray

Place a washing tray in the sink, and attach a tray siphon to it. Or place a tray with holes into the sink and drop a hose from the faucet into the tray. Fill the tray halfway with water near 68°F (20°C).

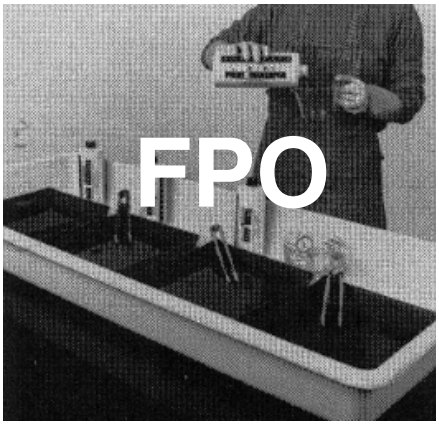
You can use a holding tray into which film is deposited after processing. At the end of the darkroom session, carry the holding tray into another room to wash the film.

6

Diluting the developer

Mix the developer to obtain a total of approximately 20 oz. For instance, use 3 oz (89 ml) Kodak Dektol with 18 oz (532 ml) water. If you are making high-contrast negatives, use 10 oz (296 ml) lith A developer with 10 oz lith B developer.

Because the developer does not last long in a tray, mix it last, but set it up as the first tray. Thoroughly wash and dry your hands before you return to the enlarger.



7

Preparing and making the test strip

Remove one sheet of film from the box and cut off a strip about 4 in. (10 cm) wide. Return the rest of the sheet to the wrapping, place that package in the box, and close the lid tightly.

Place the unexposed test strip, emulsion side up, in the easel, positioned so it will cover the most important areas. Turn on the enlarger light for 5 seconds.

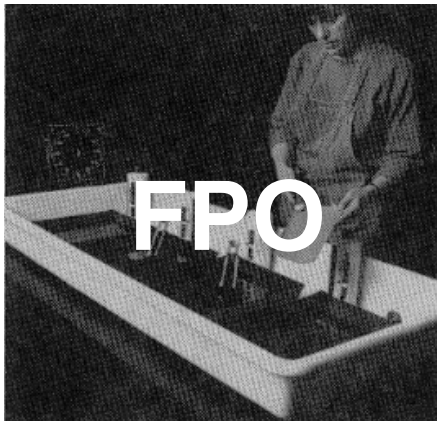
8

Exposing the rest of the strip

Cover 1/5 of the strip with cardboard, and expose the uncovered 4/5 portion for 5 seconds more. The band covered by the card now has 5 seconds' exposure; the rest of the strip has 10 seconds' exposure.

Cover 2/5 of the strip with cardboard and expose the uncovered portion for 10 seconds. The bands covered by the cardboard now have 5 and 10 seconds of light, the uncovered portion 20 seconds.

Cover 3/5 of the strip, and expose the uncovered portions for 20 seconds. The covered bands now have 5, 10, and 20 seconds of exposure; the uncovered portion has 40 seconds.

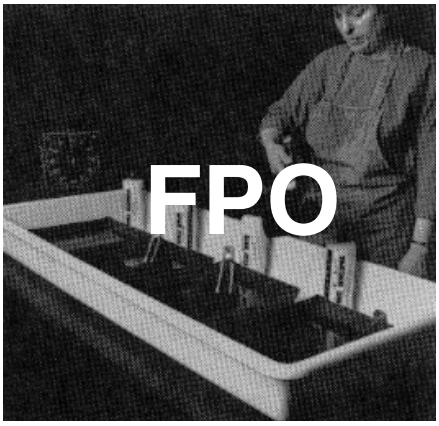


Cover 4/5 of the strip, and expose the uncovered portion for 40 seconds. The strip now has bands of 5, 10, 20, 40, and 80 seconds of exposure. Remove the strip from the easel.

9

Developing the test strip

Set a wall timer for 2 min 15 sec. Using tongs, slip the short side of the strip, emulsion up, into developer as quickly as possible. Start the timing and rock the tray gently for the entire development time. To ensure even development, *immediately* tip the tray slightly so that the liquid is deeper at the other end and then lower the tray, causing a small wave of developer to wash over the film. Gently rock the tray for the rest of the time.



10

Stopping the development

Using developer tongs, pick up the edge of the film and remove the strip from the developer. Slip the film into stop bath, avoiding contact with stop by the developer tongs. Agitate for 20 seconds with gentle tray rocking.

11

Fixing the test strip

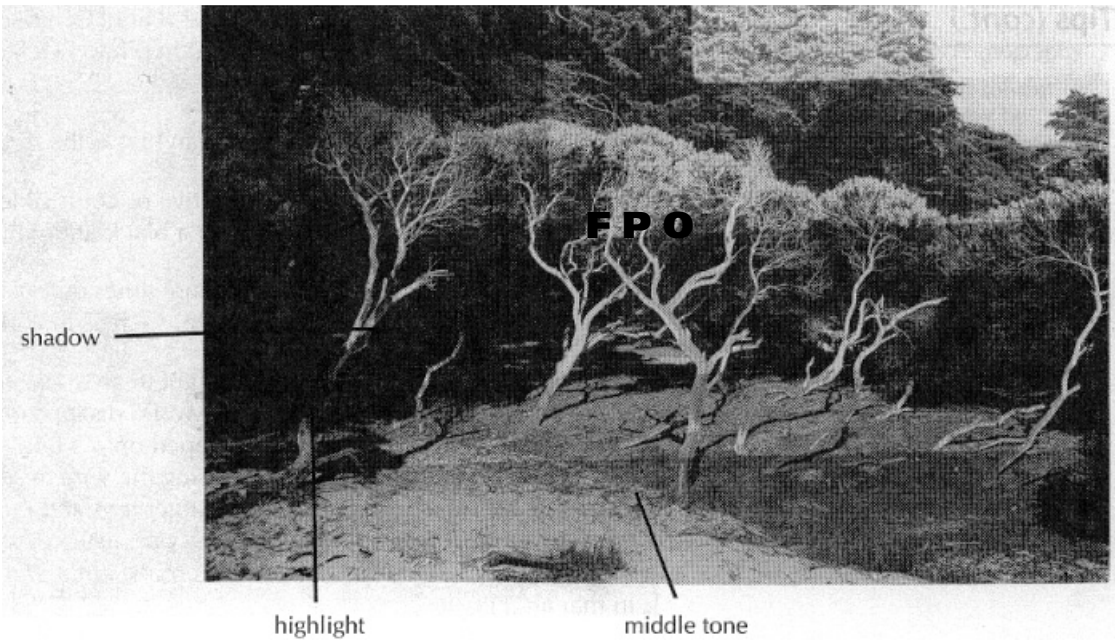
Remove the film from the stop bath with stop tongs, and immerse film in the fixer. Pick up the film with the fixer tongs and hold it toward the safelight. Notice its milky, opaque appearance. Return the strip to the fixer for 30 seconds.

Pick up the strip and hold it to the safelight again. Is it semitransparent? If so, immerse the strip in the fixer for 15 seconds more. Repeat this procedure until you can see the safelight through clear areas of the film. Notice how long that clearing took, and leave the strip in the fixer for that number of seconds more (twice the time it took to clear).

12

Washing the test strip

Turn the room lights on. Remove the film from the fixer with fixer tongs and wash the strip in running water for 2 minutes.



Tips *(cont.)*

■ The less diluted the Dektol, such as 1:3, the greater the contrast and the less middle tones in the image. If you dilute the Dektol more than 1:6, you will end up with a flatter, more grayish transparency. This principle holds true for all the listed developers except lith A and B.

■ A procedure of briefly developing in lith A and B or Dektol 1:2 until rich blacks appear, then rinsing the film and finishing the development in diluted Dektol produces a wide range of tones.

■ If the film turns out brown rather than black, the developer has gone bad or it is too dilute. With duplicating film, it is helpful to make sure you have a little film under the easel blades, thus making a border. If that border is brown, rather than black, the developer is the culprit.

■ If the film appears to have wave lines (almost like the waves of the ocean), big blobby bubble marks, or streaks that look like the bottom of the tray (if you used a tray with ridges), it probably is a sign of uneven development. Did you agitate the film consistently during development? Did the film stick to the bottom of the developer tray? Did you insert the film emulsion down by accident?

■ If you are starting with a color negative or color slide positive, your results will be less detailed than when starting with a black-and-white camera negative.

■ *Never* make a decision about exposure times by viewing the test strips under a safelight. Always judge by white light, such as that of a light table.

■ *Dodging* is a way of holding back light in an area, such as a shadow, that could end up so black that the detail would disappear. A circle of opaque cardboard 1 in. (2.5 cm) in diameter taped onto a 6 in. (15 cm) length of

Exposing the Film

13

Exposing the film

Set the enlarger timer for the proper exposure as indicated by your test strip, then turn on the enlarger and check the focus of the image with a grain focuser or magnifier. Make sure the aperture is where you want it, and turn off the enlarger light.

Securely place a full sheet of unexposed film in the easel, being sure to wrap up and cover the rest of the film. Make the exposure.

14

Processing the film

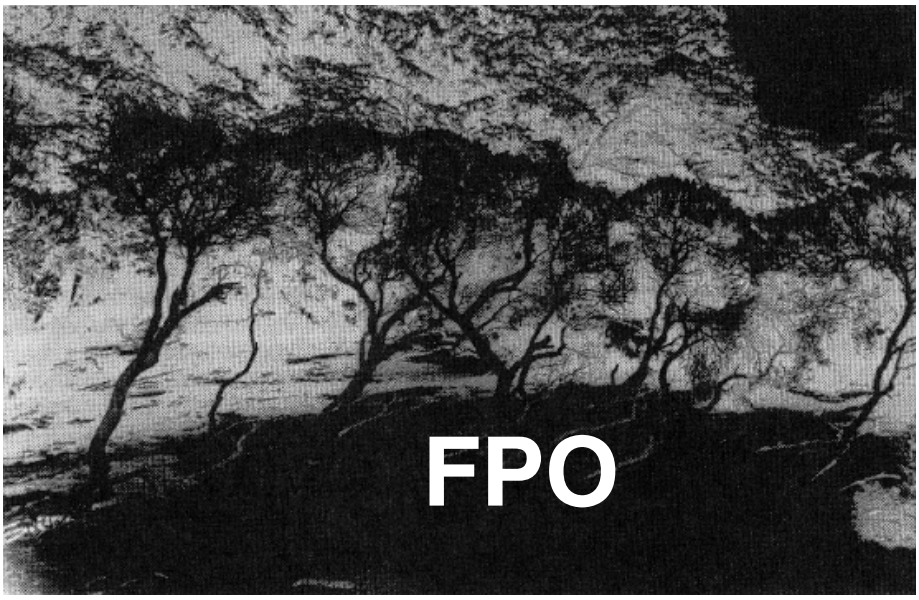
Develop, stop, and fix as you did for the test strip, using the tongs outside the image area to avoid scratching the film. Slip the film into fixer remover for 2 minutes. Hook up the tray siphon, and with the room lights on, wash your film in running water for 5 minutes, then immerse it in a 20 oz tray of wetting agent for 1 minute with no agitation. Hang the film to dry in a dust-free area.

florist wire works well as a dodging tool. Using the wire as a handle, hold the tool halfway between the film and the enlarger lens and rapidly move it in a circular direction over the shadow area *during* the exposure. (With duplicating film, dodging will make a shadow less transparent and usually will add detail in that area.)

■ *Burning,* conversely, occurs *after* the main exposure and adds detail in a highlight. Punch a hole the width of a pencil through an 11 × 14 in. (28 × 35.5 cm) piece of opaque gray cardboard. Hold this card halfway between the lens and the easel and turn on the enlarger light. You can see the image on the cardboard, so quickly position the hole over the highlight area and rapidly move the cardboard in small circles. (With duplicating film, burning uncovers detail in a highlight by making that area more transparent.)

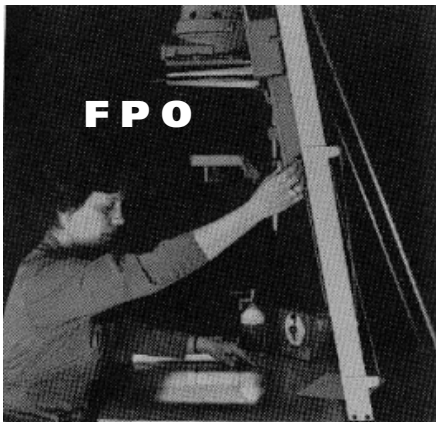
Going from Positive to Negative

If you projected a camera negative onto lith film, you now have an enlarged positive, which you can save for special effects when you start photo printmaking. (A positive transparency will print as a negative image.) You will need an enlarged negative, however, if you want a positive print. If you used duplicating film and a camera negative, you now have an enlarged negative and need not proceed with steps 15 through 17.



An enlarged negative.

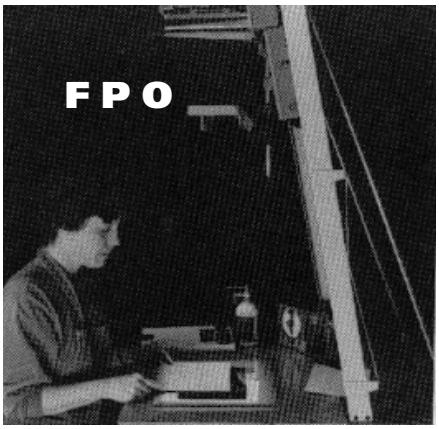
Making an Enlarged Negative



15

Checking the light

Remove the camera negative, carrier, and easel, replacing the easel with a contact printing frame or plate glass. Reinsert the empty negative carrier, and turn on the enlarger to make sure the head is high enough to project a rectangle of light that covers the area of the contact printing frame or glass. Throw the focus off slightly so as to minimize possibly printing dust from the condenser. Again, start by setting the lens to f/8. Turn off the enlarger light.



16

Cutting a new test strip

Clean off both sides of the glass and place a fresh 4 in. (10 cm) strip of lith film, emulsion (light side) up, under the glass. Wrap up the rest of the film and dust the dry film positive with an anti-stat brush.

On top of the unexposed strip of film, place the dry film positive under the glass so that it is wrong-reading (reversed).

Use cardboard and make a test strip as you did in steps 7–12. Remove the test strip and process in chemicals as you did before.

17

Making the negative

Having determined the correct exposure from inspecting the test strip, with dry hands take out a fresh sheet of lith film. Place the film under glass, emulsion side up, place the positive emulsion side down on top of the unexposed lith film, and then position the glass on top. Expose for the determined time and remove the new sheet of lith film. Process in chemicals as before and hang the film to dry in a dust-free area.

Tips

■ You can test for the emulsion on developed film by making a scratch outside the image area. If the black lifts off, you are scratching the emulsion side.

■ Poor contact between the positive and the new sheet of film can cause out-of-focus images. You might employ a print frame, plate glass with hard rubber foam, a sandwich with glass under and plate glass over, or a vacuum frame, all of which evenly press the positive to the film. See page 44 for instructions on building a vacuum board. The weight of plate glass eliminates the problem of poor contact.

■ Lith film will start to develop if it just sits in the developer, but development will be slower and uneven, causing streaks. Because the amount of agitation affects the film, you must consistently and gently rock each tray of chemicals. Remember to use a tray larger than the sheet of film and to leave a border around the image.

■ You can simulate full-color prints with gum bichromate and casein by making posterized negatives. Notice on your test strip that one band records mostly the shadows, one records the overall image (the one you selected already), and one band records mostly the highlights. That is, one band should be 80% black, one band should be 50% black and 50% transparent, and one band should be 80% transparent. If you make three full-size negatives with these three exposures, you can use them later to print three different colors (usually blue-green cyan, deep red magenta, and yellow).

■ Upon inspecting your negatives or positives, you may see clear specks or pinholes in the blacks. Kodak makes liquid opaque, and Grumbacher manufactures cake opaque, for touching up with a 000 brush. I recommend red opaque so that you can see where you have retouched; both opaques can be washed off. By applying four drops of red food dye mixed with ¼ oz (7 ml) water to a semitransparent or transparent area, you can slightly darken the negative, which will lighten the print. Make sure opaques are dry before you print.

■ Unwanted black spots in clear areas can be removed by carefully scratching on the dry emulsion side with a sharp stencil knife. Dark areas can be lightened with household bleach or Farmer's Reducer (from a photo store) on a cotton swab.

Making Color Separations

In Polaroid's wonderful *Instant Projects* (see Bibliography under "Transfers and Lifts"), Elaine O'Neil has written a clear explanation and provided funny illustrations for making direct color separation negatives for tricolor processes such as gum bichromate printing. I have altered her instructions so that you can use other format cameras and films, but the advantage of using a large-format camera is that you can contact print the negative without enlarging. The advantage of using Polaroid film is that you can check the quality of your resultant negative immediately.

You will need a camera loaded with black-and-white film or a large-format camera (such as 4 × 5 in.) fitted with a Polaroid back and Type 55 P/N film. Sodium sulfite in a bucket is recommended for clearing Polaroid film. I buy all

Making Color Separations *(cont.)*

my Polaroid equipment (and I am a Polaroid devotee) from Graphic Center, listed in the Supply Sources. You also need a normal focal length lens, a tripod and cable release, an exposure meter, Kodak Separation Guide (color control patches) and gray scale from a good photography store, and filters to fit the lens (#47 blue, #58 green, and #25 red, again from a photography store).

Your results will not be blurry if you work with nonbreathing, unmoving subjects, such as items you set up in a still life. Include the color patches and gray scale at the edge of the image, so that you can later eliminate them. With Polaroid, you can shoot one negative with the patches, check their rendition on the film, and then shoot a second negative without the patches. Meter and expose the film as you would normally. Check the gray scale and the image to make sure you have clear divisions and detail in the shadows and highlights. Adjust the exposure, if necessary.

Fit the blue filter over the lens (I even tape it), but increase the exposure by $2\frac{2}{3}$ stops. Remove the blue filter and fit the green filter over the camera lens. Expose with 3 stops more light than when using no filter. Finally, remove the green filter and equip the lens with the red filter. Use the same exposure as green if you are working in daylight or with electronic flash; use a 2-stop increase if the scene is illuminated by tungsten. Process Polaroid film immediately after each exposure. With conventional film, you will need to follow the instructions for enlarging a negative with a darkroom and check the enlarged film to see that it closely resembles the camera-generated negatives.

Converting Your Enlarger into a Process Camera

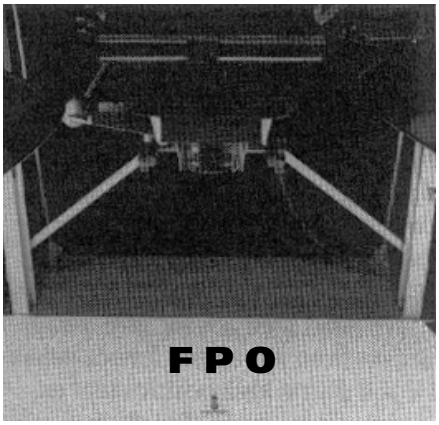
To make negatives directly from a painting, photo, found images, or real object, an enlarger can be temporarily converted into a makeshift process or stat camera by reversing the normal use of the optical system. The material to be photographed is laid on the baseboard of the enlarger, and the lith film that is to record the copy is placed in the negative carrier above the lens. Any enlarger can be used, but working in a 35 mm format with a 50 mm enlarger lens yields the least detailed results. A 4×5 in. (10×12.5 cm) format enlarger with a 135 mm or 150 mm lens rivals a professional process camera for recording detail. Working in $2\frac{1}{4}$ in. (5.25 cm) square format with an 80 mm lens gives the next best results.

Any matching pair of desk lamps with 60-watt bulbs can be used for lighting copy. Place them 6 in. (15.25 cm) beyond the edge of the copy and no higher than one-third the distance of the copy to the lens. Use an old camera negative to practice focusing, and a sheet of white paper to cover the enlarger's baseboard.

Tip

■ If you are copying real objects, use only shallow three-dimensional items because tall objects probably will be partly out of focus.

Using the Converted Enlarger



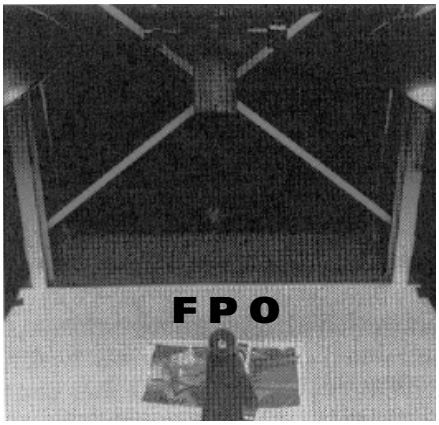
1

Setting up

Secure the white paper to the edges of the baseboard with tape.

Test the angle of the two desk lamp lights by sticking a pushpin in the center of the baseboard directly below the enlarger lens. The enlarger light should be turned off, but the desk lamps should be on. Adjust the lamps until the shadows on either side of the pin are lined up and are of the same length and darkness. Remove the pin and turn off the lamps.

Center the artwork under the lens. Use masking tape to secure the corners of the copy to the white paper.

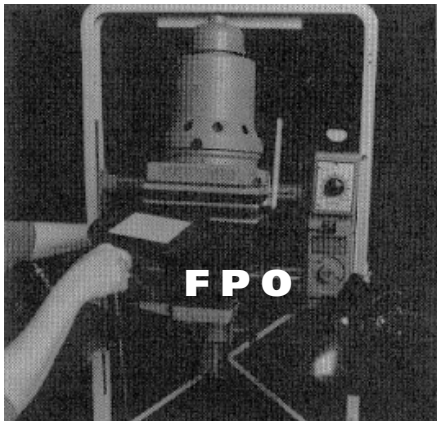


2

Adjusting the lens

Insert the empty negative carrier into the enlarger and turn on the enlarger light. Correct the height of the enlarger head while adjusting the focus until a sharp-edged rectangle of light covers the copy and leaves little room to spare.

Place an old camera negative in the carrier. Use the enlarger light to project this negative onto your copy. With a grain magnifier in the center of the image area, carefully adjust the focus and double-check to make sure the projected light covers the copy. Lock the enlarger tightly, remove the negative and the carrier, and turn off the enlarger light.



3

Loading the negative carrier

Cut a piece of ortho lith film that fits flatly into the carrier. Place the film emulsion side (light side) down (see previous instructions in the section Finding the Emulsion Side, p. 72).

Insert the carrier with the ortho film into the enlarger, being careful not to jar the focus. The exposure probably will be between 2 and 30 seconds at f/8. Set the timer and the lens aperture, and make an exposure at 10 seconds.

4

Processing the film

Remove the film from the carrier and process it. Use a standard lith or paper developer, diluted as described previously (see Making the Stock Solution and Setting up the Wet Side). Stop, fix, clear, wash, and Photo-Flo the film as in steps 9–11, page 75, and step 14, page 77.

View the negative against a light table or window. Using a magnifying loupe, check the density and focus (see page 73, How Should the Strip Appear?) If the negative is too black and dense, cut back the exposure time; if the negative is too thin and transparent, add exposure time.

Using a Process Camera

A graphic arts camera (or *process* or *stat* camera) makes a negative directly from a painting, photograph, or print. Many graphic design studios and almost all offset printers used these cameras. Some rental darkrooms and art schools, too, have a process camera. Bear in mind that if you do not have access to a process camera, you can convert an enlarger to a process camera using the instructions in the previous section. However, as digitized imaging systems take over and former manufacturers such as Agfa cease making process cameras,

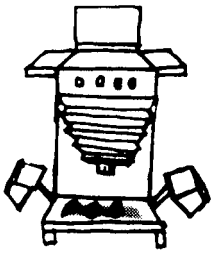
Using a Process Camera *(cont.)*

they have become inexpensive to buy. I have even seen ads for give-aways in classified shopper magazines.

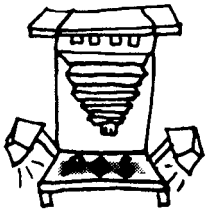
Making negatives from a process camera differs from digital and other systems in appearance, cost, and time. If you start with a positive (flat or shallow three-dimensional real objects and/or artwork), you go directly to a negative when using reversal orthochromatic film such as Kodalith. Not only does this save the intermediate step of first making a positive, as described in the section Using an Enlarger, but this method also retains much more detail and allows you to cast shadows and produce a heightened sense of realism.

Process cameras and hand-held cameras both work by the same principle: light reflected off real objects is directed through a lens and onto film. The stat camera has strong lights that bounce off your original artwork, through a big camera lens, and onto the ortho film's emulsion. Consult the general description on making negatives earlier in this chapter; it includes safety warnings and a chart on graphic arts film, their properties, and uses.

Method Overview



1 Original artwork is centered on the copyboard. The camera is focused and the film is positioned within the image area.



2 The camera lights are turned on, exposing the film.

3 The film is developed; it yields a negative the same size as, larger than, or smaller than the artwork.

Materials

1 Image. You can use any kind of flat art, such as a drawing, photograph, collage, or type; you can use real objects, such as clothing or sand; or you can use a combination of these items. Flat copy is placed under the glass of the copyboard. You can also use shallow three-dimensional objects, such as seashells or flowers placed on top of the copyboard glass.

2 Orthochromatic film. See page 66, item 2. If you want to make a negative for most photo-printmaking techniques, use reversal lith film on the stat camera.

3 Photo chemicals. See page 67, item 3.

4 A darkroom with a stat camera. Film is sensitive to white light until it has been bathed in fixer, so you will need access to a darkroom. You can use a red safelight, such as a Kodak 1A, in the darkroom, and it will not affect the film after it has been removed from its light-tight packaging. Because the chemicals are unsafe to breathe, the darkroom should have a good ventilating fan.

The stat camera should have a 16 × 20 in. (40.5 × 50.75 cm) piece of frosted acetate centered on the viewing glass with a tape hinge on one edge. You can see and focus the image on the frosted acetate, but lift it up when you place the film on the viewing glass.

5 One-gallon brown storage bottles for storing diluted photo chemicals. You will need one bottle for print developer (two bottles for lith developer), one bottle for the stop bath, one for the fixer, and one for the fixer remover. Bottles may be purchased at photography stores or donated by your pharmacist. Bottles should be labeled as to contents and date mixed.

6 Stirring rod or stainless steel iced tea spoon for mixing chemicals with water.

7 Funnel for pouring chemicals into storage bottles.

8 Trays or plastic dish tubs. You need at least three trays larger than the size of the film you are processing. To avoid contamination, mark each one with laundry-marker pen: *developer, stop, fixer.* You may want a fourth tray for the fixer remover, a fifth for the water wash, and a sixth tray for the wetting agent bath. Another option is Jobo or BTZS equipment, as explained in the Materials list at the beginning of this chapter.

9 Timer, such as a GraLab timer or a clock with a sweep second hand, is needed to time the steps when processing film. The timer should range from 1 second to 60 minutes.

10 Photographic thermometer showing at least 50–125°F (10–50°C) to measure water and chemical temperature during film processing. All photo chemicals should be used at around 68°F (20°C) unless the manufacturer recommends otherwise.

11 Graduate or measuring cup is needed to measure and dilute chemicals for use. The most useful size is 32 oz (946 ml), with 1 oz (30 ml) increment markings.

12 Print tongs, available at photography stores, move the ortho film from one tray to the next; use different tongs in each tray of chemical solution. Label the tongs according to which chemical they touch, but do not use your hands in the chemicals at any time. Tongs are one of the least expensive items, so buy good ones that are easy to manipulate, such as the wishbone-shaped plastic tongs with rubber tips made by Cesco Lite. Metal tongs can scratch the film.

13 Siphon print washer or tray with holes punctured on the sides aids in washing sheet film.

14 Anti-stat brush or lens tissue removes dust from the camera lens. Both items are available in photography stores.

Using a Process Camera *(cont.)*

15 Loupe or magnifying glass helps focus the process camera when viewing a finished ortho negative. An 8× loupe can be purchased at photography or graphic arts stores, and a 12× loupe is carried in silkscreen supply stores.

16 Proportion wheel simplifies calculations for the ratio of enlargement or reduction. The operation of a proportion wheel is explained later in this chapter (p. 88). You can buy one at graphic arts stores.

17 Scissors are needed to cut film test strips in the darkroom.

18 Masking tape comes in handy for labeling chemicals and holding steady test strips of sheet film. It is used to delineate edges of the image projected onto the frosted acetate.

19 Record sheet for writing notes. You can set up your own sheet, so bring a black pen or pencil into the darkroom with you. Jot down what you are doing and your evaluation of the outcome.

20 Glass cleaner, paper towels, ruler, and hand towel all are helpful to have in the darkroom.

How the Process Camera Works

Copy is a term applied to the artwork being reproduced. One of the nicest features of a graphic arts camera is that you can easily combine words, imagery, and real objects onto one negative, or you can backlight the copy in order to make negatives from slides or artwork on acetate.

The *copyboard* is where your original art is placed. Make sure that the copyboard is black for artwork on paper, or that the back is removed to expose frosted glass underneath for backlighting transparent copy. All glass must be absolutely clean. Place the copy in the center of the copyboard and, if your camera has a vacuum, turn it on. Remember to turn the vacuum off if you want to lift the glass on the copyboard. Three-dimensional objects go on top of the glass.

The *back* is opened for viewing and always closed during an exposure. Most cameras come with a vacuumized back, but you probably will not need to turn on the vacuum function to make the continuous-tone or high-contrast negatives for the photo-printmaking processes described in this book.

Controls are used for turning on and off the main power, the vacuum, and the lights, and for backlighting the copy.

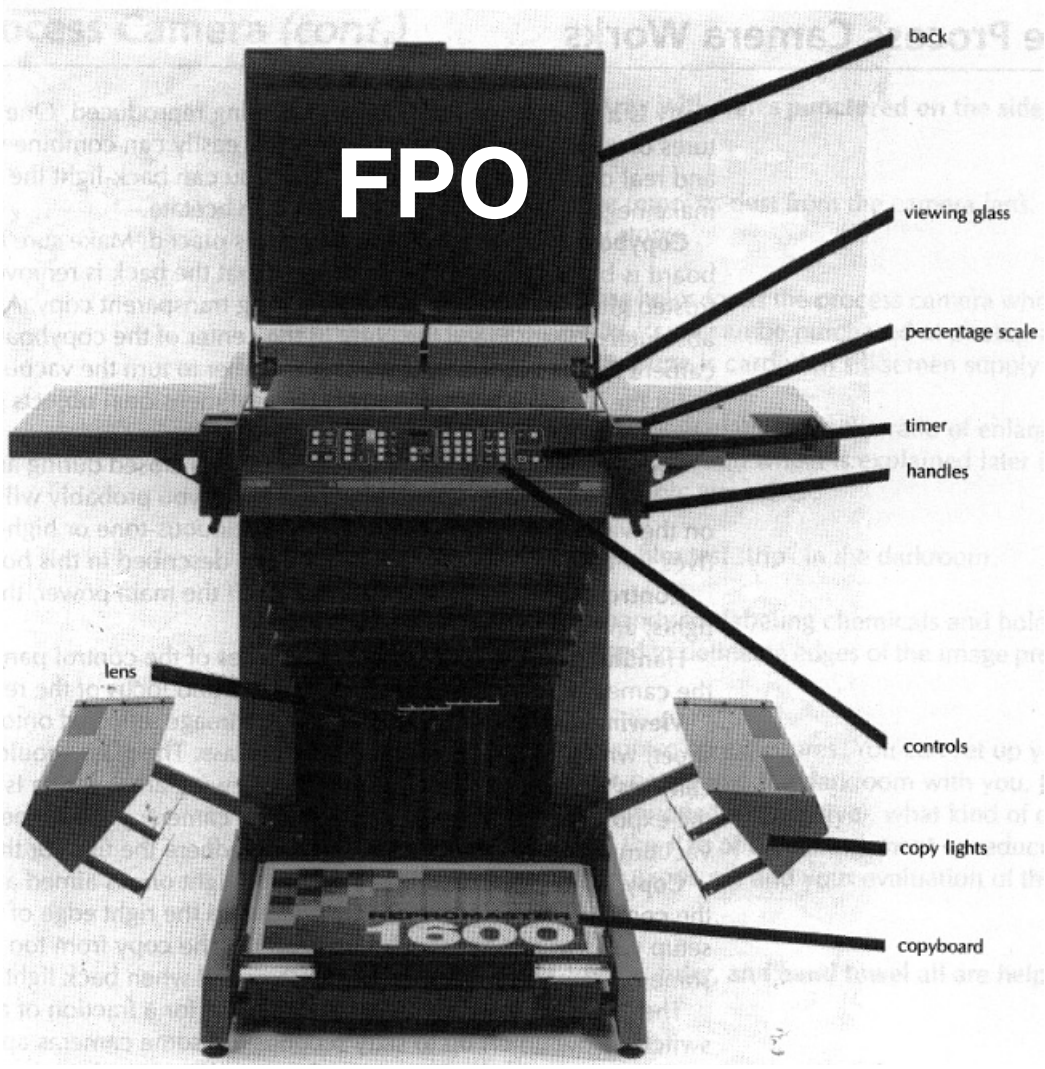
Handles or *buttons,* found on both sides of the control panel, raise or lower the camera parts and thus change the size and focus of the reflected image.

The *viewing glass* is where you can see the image reflected onto a frosted acetate sheet, which is hinged with tape to the glass. The glass should be clean. Some cameras are made with a frosted glass viewing area, which is removed during the exposure. If you are using this type of camera, you will need to turn on the vacuum function of the back in order to adhere the film for the exposure.

Copy lights must be angled so that the right one is aimed at the left side of the copy and the left one is directed toward the right edge of the copy. This setup will avoid a *hot spot* in the center of the copy from too much light. On some cameras, copy lights must be removed when backlighting is desired.

The *timer* allows you to turn on the lights for periods ranging from a fraction of a second (the "sec" switch below the timer) up to 60 seconds (on some cameras this appears as a "times ten" or "×10" switch). To turn on the copy lights, push in the *timer button* for an exposure or the *focus button* while focusing.

The *percentage scale* indicates with a hairline or arrow the amount you are reducing or enlarging the copy when making the negative. For instance, at 100% the negative will be the same size as the copy, at 200% the negative will be twice as large as the copy, and at 50% the negative will be half the size of the copy. Usually there are two tapes printed with percentage numbers controlled by the two handles or buttons. The numbers on each of the tapes will match each other when the flat copy is in focus. The numbers will be slightly askew when shallow three-dimensional copy is in focus. Use a proportion wheel (see page 87) to calculate the percentage.



The process camera.

How the Process Camera Works *(cont.)*

The lens should be 210 mm for reductions to 50%, enlargements to 200%, and reproduction of 100% negatives. The lens should be 350 mm for reductions below 50% and enlargements above 200%. The aperture of the lens can be changed in the same way as any camera or enlarger lens, but the f/stops usually start at f/16 and go down to f/45. Read page 70 for a more detailed explanation.

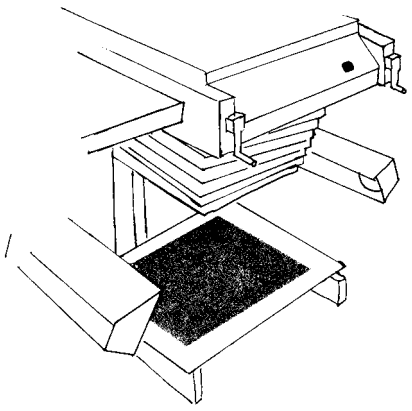
Tips

■ Read the Tips sections on pages 72–73, 76–77, and 79.

■ If you need to have a negative made, you can bring your artwork to a printer. The printer probably will use a stat camera to make a high-contrast negative or a halftone negative, but most likely will not produce a continuous-tone negative.

■ The copy lights on the stat camera are often quartz bulbs, which never should be touched with bare hands because the oils from your hands will ruin them. Wear gloves when handling quartz bulbs.

Making the Negative

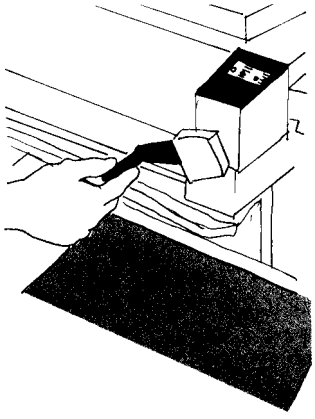


1

Preparing the darkroom

Set up the chemicals as explained in the previous instructions under Setting up the Wet Side. Turn on the main power to the camera and the power to the lights, but do not turn on the lights.

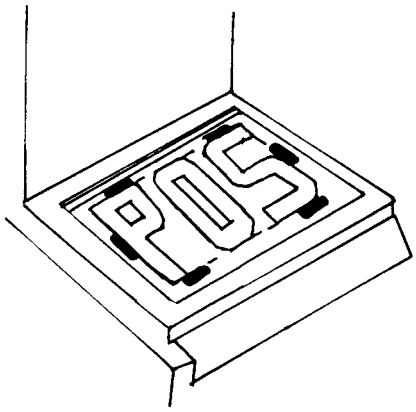
Clean the viewing glass and both sides of the copyboard glass, then center the artwork under the copyboard.



2

Setting the percentage

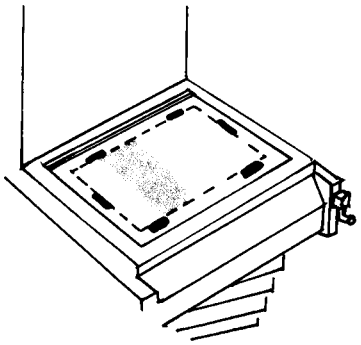
Calculate the percentage of enlargement or reduction with a proportion wheel (see page 87). Check that you are using the correct lens, and turn the handles to set the tapes to the correct percentage numbers. If you want the negative to be the same size as the copy, set the tapes at 100%.



3

Focusing the image

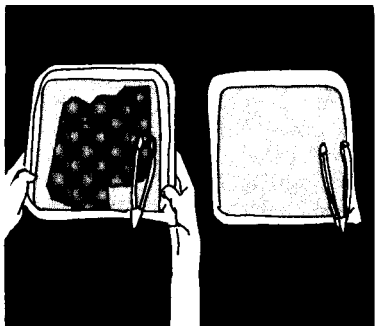
Open the lens aperture all the way, and turn on the copy lights with the focus button. Check the image on the viewing acetate with a loupe as you fine-focus the copy by slowly turning the percentage scale controls. Mark the outer border of the image by tacking down small strips of masking tape on the acetate. The film later will be placed within and under these markers. Turn off the camera lights. Set the camera lens to f/22 as a starting point for continuous-tone and high-contrast negatives.



4

Cutting the test strips

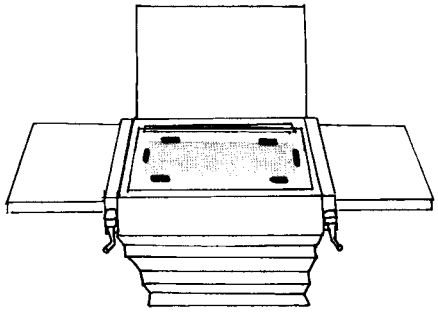
Cut a strip off the sheet film 2 in. (5 cm) wide by whatever length your film is, and clip a corner off it. Place the strip with emulsion facing the copy and *under* the acetate on the viewing glass (see page 72, Finding the Emulsion Side). Lock the back down. Make sure that the rest of the film is wrapped and covered in the box, and then set the timer for 10 seconds. Expose the strip by pushing in the timer button. Return the strip to the box, and cut another 2 in. strip. Notch it on two corners, place it in the same position as the first strip, and expose it for 20 seconds. Repeat this procedure with a third strip notched on three corners for a 30-second exposure, and a fourth strip notched on four corners for a 40-second exposure.



5

Processing the strips

Turn off the vacuum, lift up the back, and develop, stop, fix, and wash the test strips as in steps 9–11, page 75. Evaluate test strips based on the negative as illustrated on page 76, How Should the Strip Appear?



6

Making the negative

With clean, dry hands, take a full sheet of film from the box, making sure to wrap and box the rest of the film. Lift up the acetate and place the film on the glass within the borders marked by the masking tape. Make sure that the emulsion faces down, close the back, and expose for the proper time. Develop, stop, fix, hypo clear, and wash as in step 14, page 77. Hang the film to dry in a dust-free place.

■ Many graphic arts cameras show two sets of numbers printed in two different colors on each of the two percentage tapes. The colors coordinate with the colors printed on the lenses. For instance, the blue numbers are to be used with the blue coded lens, and the orange numbers go with the orange lens.

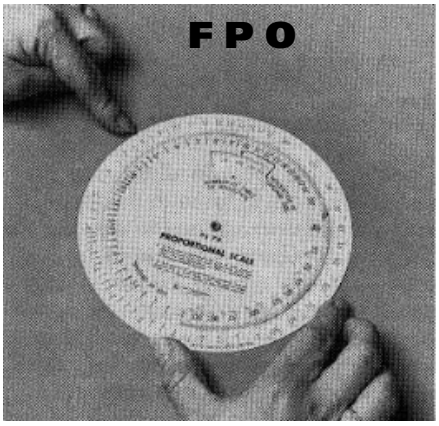
■ Make sure, when you are calculating the percentage of reduction or enlargement, that your film will accommodate the image size.

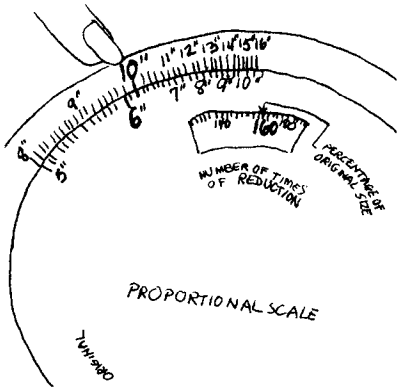
Using a Proportion Wheel

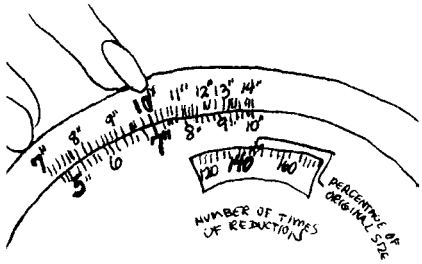
The proportion wheel facilitates the calculation of the exact dimensions as well as the percentage of enlargement or reduction. It is indispensable when using a process camera or an enlarger converted to a process camera. It proves helpful in other situations, too, such as when you send out a camera negative or artwork to be enlarged or reduced in a commercial shop and you want to instruct the camera or computer operator regarding the exact percentage of alteration.

The instructions here describe a typical enlargement, but the wheel also will calculate reductions in a similar step-by-step way.

Using a Proportion Wheel *(cont.)*







1

Lining up the numbers

Let us pretend that you have measured your original artwork, and it is 5 × 7 in. (12.5 × 17.75 cm). You want an 8 × 10 in. (20.25 × 25.5 cm) enlargement. The inner wheel marks the measurements for the original artwork, so look for the 5 in. (12.5 cm) mark on the inner wheel. The outer wheel enumerates the dimensions of the reproduction size, so look for the 8 in. (20.25 cm) mark on the outer wheel and line it up with the 5 in. mark. Both of these numbers refer to the width of the image.

Check the window with the arrows. It shows that you want a 160% enlargement, so you can set the percentage scale bands on the process camera at 160%. Make sure that the camera is equipped with a lens that will enlarge to 160%.

Notice the other dimension of the original: the length mark of 7 in. (17.75 cm) on the inner wheel lines up with the mark for 11¼ in. (28.5 cm) on the reproduction size part of the wheel. Is your film large enough to accommodate this size?

2

Calculating one's choices

The proportion wheel indicates choices. If you want the image to fit onto a 10 in. length of film, look at the 10 in. mark on the outer wheel. It lines up with the 6¼ in. (15.75 cm) marker on the inner wheel. You can cut down (*crop*) the 5 × 7 in. image to 5 × 6¼ in. (12.5 × 15.75 cm) in order to fit on the 8 × 10 in. (20.25 × 25.5 cm) sheet of film. Keep the camera set at 160%.

3

Computing other options

Move the wheels so that the inner wheel 7 in. (17.75 cm) mark lines up with the 10 in. (25.5 cm) mark on the outer wheel. Both these figures refer to the length. Notice that 5 in. (12.5 cm) now lines up with 7⅛ in. (18 cm) and that 142% now appears in the window.

You can crop, making the reproduction 7⅛ × 10 in. (18 × 25.5 cm). Set the camera at 142%.

If you remake the original artwork to 5 9/16 × 7 in. (14.25 × 17.75 cm) or 5 × 6¼ in., it will fit exactly onto an 8 × 10 in. piece of film. The proportion wheel shows you these choices if you start your calculations with the reproduction set of numbers.

WITHOUT A DARKROOM

You can create alternative photographic prints without stepping into a darkroom simply by producing imagery from real objects or stencils, drawings, computer images, or photocopies on acetate, or from old photographs made transparent. These techniques can be combined with each other or with the darkroom methods described earlier in this chapter.

Making Photograms

You can place objects directly onto the paper or fabric you have coated with one of the alternative photographic emulsions. An *opposite,* or *negative,* print is made when the paper and objects are exposed to light—wherever the object is, light is blocked, and the paper or fabric shows. Wherever there is no object, light will act on the emulsion, and the color of the coating will show. If you move objects during part of the exposure or if you use semitransparent objects such as rice paper or tissue paper, you will obtain intermediate shades of the coating on the print.

Flat, semitransparent objects yield the most detail when placed under a piece of glass during contact printing to the emulsion; this also prevents the object from being blown around during outdoor exposures. For safety in handling, tape the edges of the glass and make sure the glass is larger than the paper or fabric; otherwise, the tape will leave a mark on the print.

To exactly repeat results or to make positive prints, you can place an object directly on ortho film and expose it to light to make a photographic negative as explained in the beginning of this chapter. You do not have to use an enlarger. Exposing the film with a flashlight, overhead light, or directional light can yield interesting results.

Tips

■ If you are photogramming the pattern of a thin, printed fabric, place the printed side toward the emulsion and under the glass.

■ Fresh vegetation and other living matter can sweat moisture under glass and thus stain the print, so use a large piece of cellophane or clear plastic wrap (available in grocery stores) to cover the emulsion. Place the vegetation on top of the clear wrap, then cover the unit with the glass. For different results, you can eliminate the glass and place or pin the vegetation directly on the emulsion. Depending on the time of day or direction of the ultraviolet light, the vegetation will cast shadows that show up in the print.

Making Stencils

Graphic arts stores carry a nonphotographic red film called a *ruby* masking sheet. It blocks light and is easily cut with a stencil knife. Ruby is fairly transparent to the eye (but opaque to the emulsion), so it can be placed on top of a picture or transparency on a light table while the shape to be blocked out is traced and cut. Red masking sheets can be bought with a sticky backing so that red shapes can be adhered to clear acetate to create functional negatives. You also can find ruby in the form of a tape of various widths.

Photographic film exposed to white light or the black border of processed film can also mask light.

Tips

■ Try using precut stencils, such as the lettering guides found in art stores, to create images.

Tips *(cont.)*

■ I use ruby or a cutout portion of a reject print *on top* of glass to dodge (see Glossary, p. 187) the print during an exposure. If I were to put the ruby cutout *under* the glass, the edge of it would be too visible on the print.

Making a Paper Negative

If you have photographs made on thin, single-weight paper, such as Europe's Finest from Freestyle Camera, you can use these pictures as transparencies to create images in alternative photographic printmaking techniques. Because a photograph is a positive, however, you will end up with a negative final print, and exposures for the hand-applied emulsion described in this book will take longer. Compared with film negatives, paper negatives produce more contrasty results, but you can use a pencil on the photo to darken areas where you want to enhance detail before you print.

You can enlarge a slide, which is a positive, onto black-and-white, single-weight paper in the darkroom and achieve a negative image, which can be used as a paper negative to produce a positive alternative photographic print.

If you have a photograph on resin-coated paper, you can separate the plastic layer with the image from the backing by using a razor blade between the layers of one corner, then gently peeling the resin coating off. You will have a positive transparency ready for use. Or, try the Polaroid emulsion transfer method described in Chapter 1, but transfer onto frosted acetate.

Even newspapers or magazine pages on thin paper can be used, but bear in mind that both sides of the page will print. (The inventors of these processes started by coating tissue paper with emulsion, making an exposure either with photogram materials or with the tissue loaded in a camera, then contacting that processed and dried image to another piece of heavier paper coated with emulsion.)

With all these methods, the transparency must be weighted with glass during the exposure.

Using Cast Shadows

Selecting one of the printmaking recipes described in this book, coat paper or fabric in your studio, dry it, and load it into an opaque envelope such as black 4 ml polyethylene (available at hardware stores for garden mulching or as discarded packing from photographic sheet film and paper). Take the envelope outside, remove the coated paper or fabric, and place it so a shadow is cast on it. Exposure time will vary with the light of the day and the season of the year.

Tips

■ First practice on a plain sheet of white paper to previsualize whether you will get a blur caused by objects moving in the wind. Focus by moving the paper closer to or farther from the object casting the shadow, or create distorted patterns by angling the paper.

■ Try folding paper or fabric loosely and allowing it to cast shadows on itself.

Images on Clear Acetate

Clear *media* or *process acetate,* found in art and graphic design stores, can be used as the vehicle for drawings made with permanent markers, crayons, grease pencils, stamps and ink pads, typewriters, spray paints, or pressure-sensitive graphics (press-type). To achieve sharp detail, contact print the acetate image negative to the emulsion by weighting it down with sheet glass, or soften the image by eliminating the glass. Acetate may slightly block ultraviolet light, requiring a little extra exposure when you print.

Tip

■ A special acetate, available at photocopy centers, can be run through photocopier machines to produce a transparency from a real object, pictures, or writing laid on the glass platen. Make sure you use the correct acetate for your machine.

Found Imagery

Old negatives of varying sizes can be found in family albums, flea markets, and auctions, and usually are rich in detail. The ones on glass can be contact printed as-is to hand-applied emulsions; the ones on plastic need to be held down with a sheet of glass. In addition, newspaper publishers sometimes give away old negatives of type and halftone dotted pictures.

Transparentizing Office Copies

You can run clear acetate, onionskin paper, or Chartpak's reversal film with adhesive back through certain office photocopiers. Not all machines will take these materials, so check first with the manufacturer or technician. Or, you can transparentize a photocopy on regular paper by rubbing cooking or mineral oil into it, but remember that you have a positive transparency, which will print as a negative image later. Place a piece of cellophane or plastic wrap between the oiled photocopy and the hand-applied emulsion to prevent grease stains on your final print.

Using Special-Effects Screens

Some art stores, such as Pearl Paint (see Supply Sources) stock adhesive-backed or pressure-sensitive printed patterns on a clear backing, such as the ones made by Zip-a-tone, Letraset, C-Thru Graphics, Formatt, and Chartpak. Stores carry free or inexpensive catalogs from each company, and looking through them can provide you numerous options: grids, textures, lines, dots, topographics, architectural materials, and symbols. Press them onto clear acetate and consider combining them with such household items as open-weave fabrics and doilies or with black ink drawn on the acetate.

Sending Out Copy

Architects, designers, and mechanical engineers often send original artwork to print shops specializing in making large high-contrast or halftone negatives. Sometimes custom photography labs will make enlarged continuous-tone, black-and-white negatives from your camera negatives. Read the sections Using a Process Camera and Using a Proportion Wheel before you send out artwork. You can have enlarged negatives made digitally at a service bureau.

Using a Computer

If you have access to a laser scanner or a digital camera, a Macintosh or PC computer, and a printer, you can create usable negatives with programs such as Photoshop, CorelDraw, Picture Studio, and Fractal Printer. If you are starting with flat hard copy, such as a photograph or a collage, scan it at approximately 125 pixels per inch (49 pixels per cm). The pixel resolution of the image is referred to as *dots per inch* or *dpi* in the scanner dialog window. Try to keep the resolution at a minimum of 100 dpi to avoid a pixelated look in which pixels show in the final print as small squares (unless you want such an appearance). Scan in gray scale if you intend to use a one-color photo-printmaking process such as cyanotype, platinum or palladium, or Van Dyke brown printing for the final image. If the print will be made using a multicolor technique, such as gum bichromate printing, scan in RGB (red, green, blue). Remember that if you enlarge the image after you scan it, the resolution in the final print will be lower. Therefore, when you scan you need to have an idea of the final dimensions so that you set the scanning resolution high enough.

You can incorporate words or manipulate the image on screen before you print it out as a negative. Most programs and printers will automatically print a halftone of 50 lines per inch (lpi), which can usually be changed to a coarser dot for special effects or a finer dot for slightly more detailed results. In Photoshop the Page Setup dialog box under the File menu allows you to change the lpi and the dot shape (round, diamond, straight line, etc.) and, more important, to change the image to a negative ("invert") before printing. For best results on most laser printers, do not use an lpi higher than 80. Although the program might let you set it higher, the printer will not be capable of printing it accurately. In addition, the image may be compromised in other ways—the smooth transitions of continuous gradations could disappear, resulting in a contrasty effect.

For single-color processes you will output a single negative. For color processes you will have to convert your RGB file to CMYK (cyan, magenta, yellow, and black) before printing, and then output four separate negatives, one for each color. You may not need to use all four, depending on the colors you use and the results you desire in the finished gum print. You may be printing in blue, red, and yellow, for example, in which case you would only need the cyan, magenta, and yellow separations, not the black. To convert your RGB file to CMYK in Photoshop, use the Mode menu, and then go to Print under the File menu and click on "Print Separations" when the Print dialog box appears.

Output your negatives on transparent sheets such as 3M's CG3300, which can be purchased in 50-sheet boxes at good stationery stores and copy centers or by calling 1-800-243-4565 in the United States and asking for product

3556. Canon makes their own transparent film for their printers. This method works particularly well if the toner cartridge in the printer is fresh. Some of my students put the same acetate through the printer more than once by printing on both sides, then adding watercolors (not ink—it sticks to the carbon particles) by hand for other tones. Or, use an inkjet printer (such as the Epson), print onto paper, and rub mineral oil onto it afterward to make the paper more transparent. Do not place oily paper negatives directly onto emulsion when you use the photo-printmaking processes; place a sheet of plastic wrap under the oily paper. If you look under Computers in the Yellow Pages, most service bureaus will be able to output a negative from your disk in either 8½ × 11 in. (21.5 × 28 cm) or 11 × 17 in. (28 × 43 cm) formats. In addition, Platinum Press (see Supply sources) will make a digital negative from your original art.

Using a Pinhole Camera

Jesseca Ferguson is among a group of artists who build pinhole cameras of varying sizes to make negatives directly from a scene using graphic arts film (described earlier in this chapter) or panchromatic sheet film. She reproduces these negatives in different nonsilver processes. Some of her palladium prints can be seen on page 137. In addition, a pinhole camera loaded with Freestyle Camera's reasonably priced single-weight Europe's Finest paper works well as a paper negative. You can learn about pinhole photography from *The Hole Thing* by Jim Shull and *Pinhole Photography* by Eric Renner, published by Focal Press (see the Annotated Bibliography).

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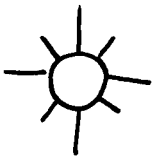
Part III LIGHT-SENSITIVE METHODS

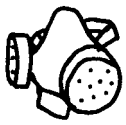


Daylight

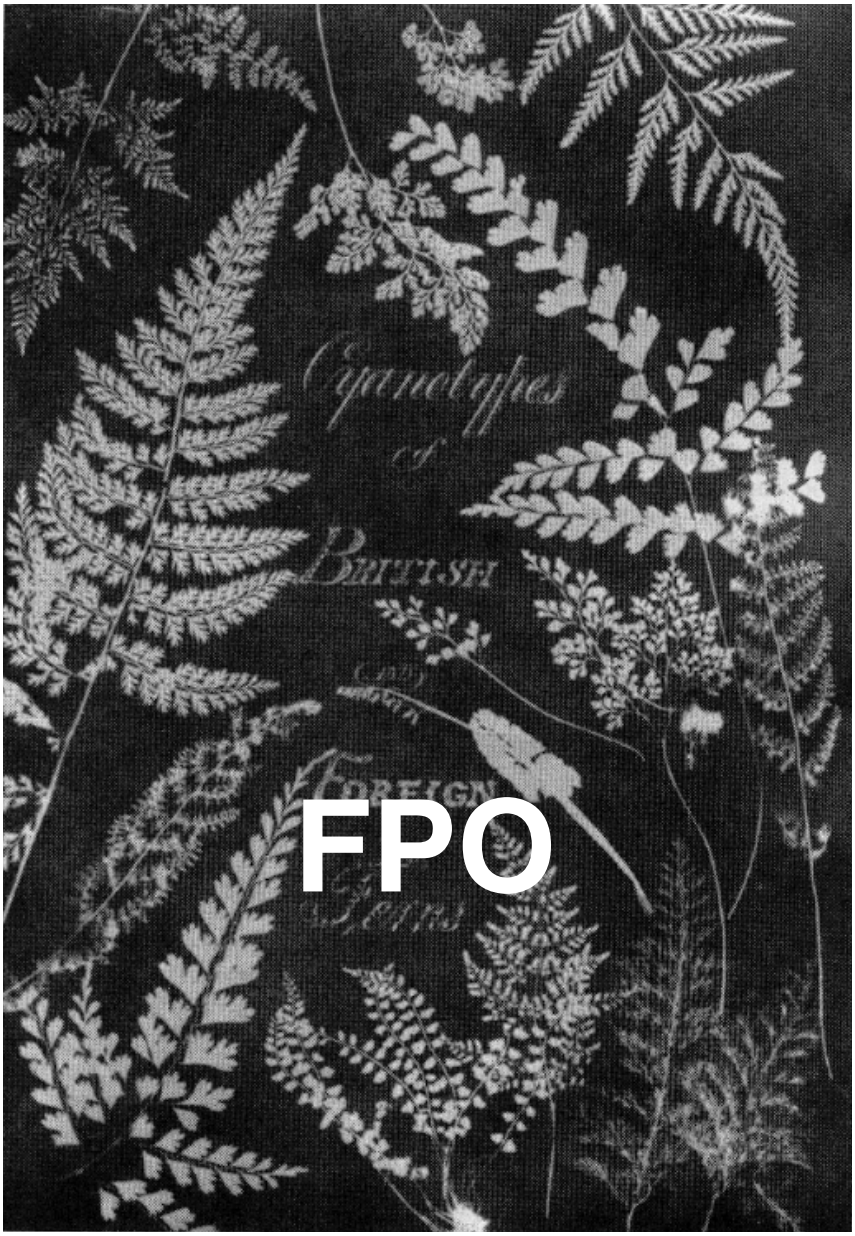
Subdued Light

Safelight

Protective Gloves



Respirator



Anna Atkins, section title page from presentation album, *Cyanotypes of British and Foreign Flowering Plants and Ferns,* circa 1851–1854, 35 × 24.5 cm cyanotype. (Courtesy Hans P. Kraus, Jr., New York.)

Chapter 6 CYANOTYPES

Cyanotypes, or *blueprints,* are light- to deep-blue images that can be inexpensively printed onto paper, fabric, and other materials. Properly made, cyanotypes are permanent and can be combined with other hand-applied emulsions as well as traditional artists' pigments and pastels. They tend to be more contrasty (containing less middle tones) than other processes described in this book.

Astronomer Sir John Herschel of England is credited with discovering blueprinting, or heliography with iron salts, in 1842. Calling the process "ferro prussiate," he used cyanotypes to reproduce his intricate mathematical tables. Soon afterward, Anna Atkins, the first woman photographer, saw photography's potential for book illustration when she lifted cyanotypes out of the mathematical sphere with her impressions of algae. Her *Cyanotypes of British and Foreign Flowering Plants and Ferns* is the first book of printed photographic imagery and text and the first photographic science book. The title page is reproduced on the facing page. More of her work can be seen in the book *Sun Gardens: Victorian Photograms* (see Bibliography). At the turn of the century, Henry LeSecq blueprinted photographic images of Gothic structures in Paris for the French government. Clarence White, a member of the British pictorialist photography group called the Linked Ring, also made cyanotypes.

Architects and engineers often make blueprints or *diazo prints* on precoated paper, which they expose through drawings done in pen and ink on tissue paper, vellum, or acetate. This precoated paper is not permanent and usually must be processed in ammonia fumes, which can cause lung problems. Palladio Co., Inc. (see Supply Sources at the end of this book) has been making a permanent machine-coated cyanotype emulsion on rag paper. It does not need to be developed in ammonia fumes.

Safety

If potassium ferricyanide comes in contact with heat higher than 300°F (147°C) or with concentrated acids, such as stop bath, a poisonous hydrogen cyanide gas will be released. Therefore, long exposures to ultraviolet light should not be done with sunlamps.

Both ferric ammonium citrate and potassium ferricyanide are toxic, so wear protective gloves when using these chemicals, and wear a protective mask when handling them in the powder form. Never ingest chemicals.

Never mix ammonia products and bleach, because the combination produces lethal fumes.

Disposal of even small amounts of cyanide, found in potassium ferricyanide, should be handled by waste disposal companies or household hazardous waste programs, a service that is usually available free or at minimal cost to

noncommercial photographers. Most universities and public schools also employ such a service. John Basye of Blueprints/Printables (see Supply Sources) says that local sewage treatment plants want to know when effluent contains cyanide and may wish to test the quantity of cyanide occurring in your household wastewater. Most fire departments also want to know the type and location of chemicals stored in your home.

Do not pour solutions in the ground, into septic tanks, or down a storm drain. If there is more than one cup of blueprint chemistry to dispose of, evaporate it to a much smaller quantity, which you can label and take to a hazardous waste area.

Clearly label bottles and keep them out of the reach of children and pets.

Method Overview

1 Paper or fabric is coated with liquid yellow cyanotype solution (a combination of two iron-based chemicals and water).

2 An enlarged negative or object is placed on top of the coated surface. Light shines through the clearer parts of the negative or around the object and hits the coating, reducing some of the ferric salt to the ferrous state, which turns the coating blue.

3 The negative is removed. The paper or fabric is developed in water, where the unexposed chemicals wash off to reveal the receiver. The exposed areas remain blue.

4 As the emulsion dries, it slowly oxidizes to a deeper blue.

Materials

More detailed descriptions of materials are given in Chapter 4, Creating the Photo-Printmaking Studio, and Chapter 5, Making Negatives.

1 Image. You will need a negative transparency the same size as the positive print you wish to create. Bear in mind that cyanotype usually is a contrasty process and that some detail will be lost. Thus, negatives with a wide range of gray, black, and clear areas tend to reproduce with less middle tones in the print. You can also use real objects.

2 Chemicals. You will need potassium ferricyanide, available at most photography stores, and ferric ammonium citrate (green anhydrous), a special-order item from one of the suppliers listed at the end of this book. Do not use brown ferric ammonium citrate. Store chemicals in a dry place with the tops on the bottles tightly capped. Photographer's Formulary sells a premeasured kit of the requisite chemicals, which is helpful if you want to try the process without buying large quantities of chemicals or if you are making only a few prints. Bostick & Sullivan and Luminos (see Supply Sources) sell premixed cyanotype solution and the New Cyanotype Kit, invented by Mike Ware in England. Author, chemist, and practitioner Ware claims that his process yields richer blues with more detail.

3 Distilled water. Sometimes tap water suffices for making the cyanotype solution, but using distilled water prevents the frustration of possibly mixing up bad solutions. A dish tub filled with hot water can be used to warm the dis-

tilled water and to keep the mixed solutions at a usable temperature while you work.

4 Receiver. For strong blues, my favorites are rag paper such as "bright" white (this is a relative term) Arches Aquarelle, or natural fabrics, such as cotton. Other choices might be Bienfang Rag Layout, Rives BFK, and rice paper on the rough side. It is easier to learn the technique on paper before you try fabric, leather, or wood.

More tightly woven fabrics, such as silk charmeuse, print a deeper blue than crêpe de chine, which prints darker than pongee. Cotton print cloth provides darker blues than sheeting, which prints a deeper blue than knits or gauze. Cyanotype can be printed on chamois leather, cotton velveteen, and viscose/rayon. Pine can be sanded and coated with blueprint solution, but you must let the emulsion sit in the dark until it is *totally* dry, or use a hair dryer until you are tired! One of my Museum School students has been blueprinting over black-and-white fiber photos.

5 Ultraviolet light. Sunlight, rather than artificial light, yields the richest blues. However, exposures can take nearly 1 hour during the New England winter, whereas they may take 5 minutes in the summer. A dependable artificial exposure unit is described on pages 45–53; it averages 20 minutes to expose a normal (not too dense or too thin) negative.

6 Sizing. Rag papers usually are made with sizing, but if you use less-expensive paper, some rice papers, or absorbent paper such as Rives BFK, size evenly with one of the types of sizing described on pages 57–58, such as spray starch, arrowroot, or gelatin. If you apply size unevenly, your prints may appear blotchy. Apply cyanotype sensitizer to the sized side of paper. Barbara Hewitt, of Blueprints/Printables, recommends washing out sizing before printing on fabric.

7 Applicators. Soft house painting, hake, or polyfoam brushes 1 in. (2.5 cm) or more wide work well for coating the solution. Wash and dry brushes between each coating procedure because contaminated brushes can produce imperfections in the next print. Avoid dipping metal brush parts in cyanotype solution unless you have first protected them with a coat of nail polish. You can float one side of the paper in a tray of cyanotype emulsion or spray the emulsion on with an atomizer.

8 Printing frame. To achieve good contact between the negative or flat object and the cyanotype emulsion, use plate glass with Masonite, another piece of glass, or foam rubber backing, or follow the instructions on pages 43–45 for building a frame. You will thus ensure that the imagery is not blurry. Make sure the glass is clean and dry before each use. Foreign particles lodged in the glass can create dimples in the print. If you are using vegetation, such as flowers or leaves, place a sheet of plastic wrap from a grocery store or clear acetate from an art store above the cyanotype emulsion. The heat from the exposure causes the vegetation to sweat, which can cause stains. Dry and press vegetation for better contact and, therefore, better resolution. If you do not use glass, carefully pin in place plants that can blow about or are far from the surface.

9 Two dark storage bottles. Recycled brown glass bottles that the chemicals came in or brown glass pint (0.5 L) fruit juice jars are ideal. The bottles should

Materials *(cont.)*

be washed and one should be labeled *Cyanotype A,* the other *Cyanotype B.* Keep liquid chemicals in tightly closed brown bottles inside sealed plastic bags in a cool, dry area. They will keep for 6 to 9 months. If a mold forms or if the emulsion is not yellow-green when you mix A and B, dispose of the liquids and mix new solutions.

10 Laundry bleach or 3% hydrogen peroxide *(optional).* Dilute and use either laundry bleach or 3% hydrogen peroxide to intensify the blue of the image, as described in the step-by-step instructions. Hydrogen peroxide solution will degas slowly and lose its potency; do not store it in a tightly capped bottle. Of the two, laundry bleach is more harmful to the environment, while hydrogen peroxide is just as effective. In *Cyanotype: The History, Science and Art of Photographic Printing in Prussian Blue,* Mike Ware states that the intensifier simply gives a preview of the deeper blue of a dry cyanotype.

11 Two trays or tubs. They must be nonmetallic and larger than the print, because one holds the intensifying solution and the other holds the wash water. A tub can also double as a container of hot water for heating up distilled water while making the stock solutions.

12 Siphon washer. This gadget, available at photography stores, works well when attached to a tray in a sink to wash prints. Or you can drill small holes up the sides of a dish tub or photo tray and gently run water directly from a faucet over the back of the print. Both methods allow clean water to enter while contaminated water drains off. Blot the print afterward with a clean, soft sponge.

13 Sheet of glass or Plexiglas *(optional).* Hold the exposed print at an angle on a sheet of glass while developing it with running water. This system allows unexposed chemicals to drain off, preventing them from contaminating the print. Wrap masking or duct tape around the edges to prevent the glass from cutting you and to cushion the glass from breaking.

14 Measuring cups or beakers and spoons. Inexpensive cookware, such as a glass measuring cup and a plastic tablespoon, will do. You will need a teaspoon for stirring chemicals and water.

15 Funnel. Use a glass or plastic funnel to pour dry chemicals when mixing the stock solutions.

16 Newspaper or oilcloth. Cover your work area, because cyanotype solution can contaminate future prints in other processes.

17 Neoprene gloves and a respirator should be worn while you work.

18 Hair dryer or clothesline and pins. If photographic negatives come in contact with wet cyanotype solution, the blacks will bleach out. Use a hair dryer on the cool setting or a fan to thoroughly dry the coating before laying a negative on top. Do not use electrical appliances near water. A clothesline and pins can be used to dry finished prints.

Making the Stock Solution

Stock Solution A

Stock solutions are the main concentrate of liquid chemistry from which working mixtures are made. This recipe is for using the emulsion under *artificial light.*

Equipment You Will Need

Ferric ammonium citrate

Brown bottle

Distilled water

Label

Funnel

Stirring spoon

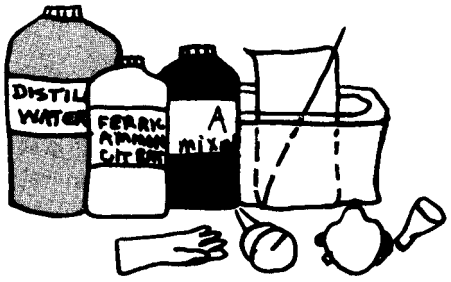
Thermometer

Measuring cup

Tub

Rubber gloves

Respirator with toxic dust filter



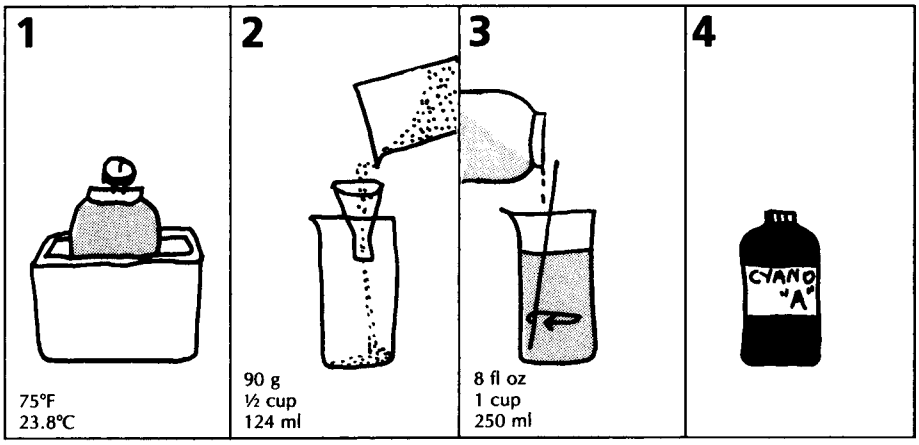
Procedure

1. Adjust water temperature to 75°F (23.8°C).

2. Using a funnel, pour 90 g (124 ml) ferric ammonium citrate into glass beaker.

3. With constant stirring, add enough water to make 8 fl oz (250 ml).

4. Stir solution until mixed and pour into a labeled brown bottle. Wash utensils in hot water.



Making the Stock Solution

Stock Solution B

Equipment You Will Need

Potassium ferricyanide

Brown bottle

Distilled water

Label

Funnel

Stirring spoon

Thermometer

Measuring cup

Tub

Neoprene gloves

Respirator with toxic dust filter

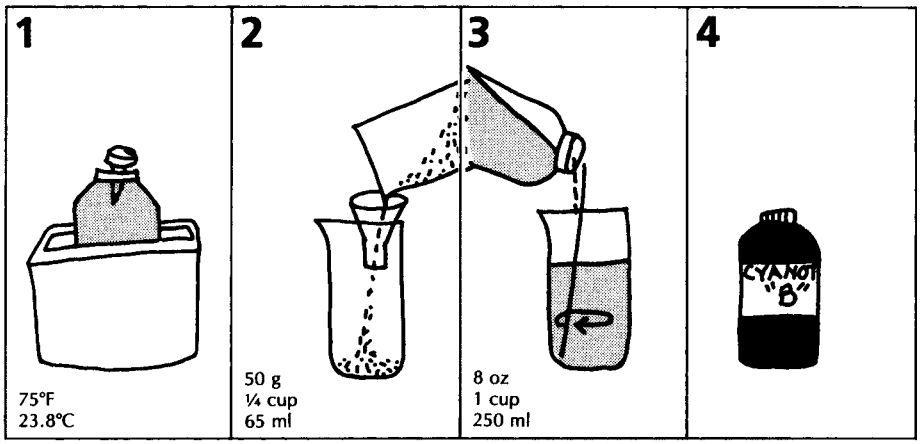
Procedure

1. Keep water temperature at 75°F (23.8°C).

2. Using a funnel, pour 50 g (65 ml) potassium ferricyanide into a beaker.

3. With constant stirring, add enough water to make 8 fl oz (250 ml).

4. Stir solution until mixed and pour into a labeled brown bottle. Thoroughly wash all utensils in hot water.



Tips

■ To shorten the exposure time later, add a little extra ferric ammonium citrate to stock solution A or mix the ferric ammonium citrate as just described but use twice as much as recommended in step 1 of Making a Cyanotype. To increase the longevity of the stock solutions and to increase their solubility (good for less porous surfaces), add a pinch (approximately 1.25 g) of oxalic acid, a crystal purchased through chemical suppliers listed in the back of this book.

■ If you are using the emulsion in *bright sunlight,* cut the recipe to ¼ cup plus 1 tsp (50 g or 65 ml) ferric ammonium citrate and enough water to make 1 cup of solution A, and ⅛ cup (35 g or 59 ml) potassium ferricyanide and enough water to make 1 cup of solution B.

■ I learned the hard way that potassium ferricyanide, even in the dry form, goes bad, albeit slowly. After mixing a fresh batch of cyanotype solutions for a class demonstration once, the exposures under my trusty ultraviolet unit were taking an hour and longer to obtain the normal, deep blues usually achieved in 20 minutes. So I did some troubleshooting, eliminating variables one by one. I dismissed the possibility that the emulsion was mixed incorrectly because all my students had watched me carefully measure. I knew I was not using a particularly dense negative for the demonstration. I tried replacing the ultraviolet bulbs, and then I tried using a new bottle of distilled water. Next I rewashed all the mixing utensils to eliminate contaminants and opened a fresh jar of ferric ammonium citrate (which I knew could deteriorate with age or prolonged exposure to light) and mixed fresh solution A. Only when I opened a new bottle of potassium ferricyanide and mixed fresh B solution did the exposures return to normal. Ferric ammonium citrate (solution A) is more readily affected by age and light, so make sure the opaque bottle is tightly sealed.

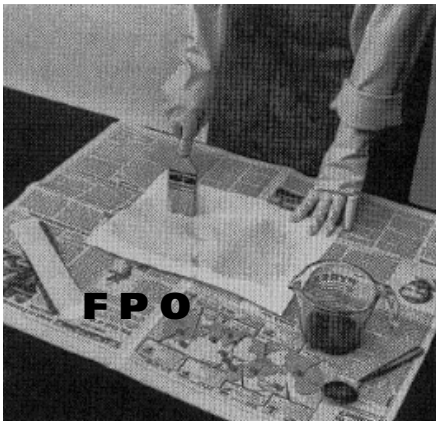
■ Stir the solution if it has been sitting (even during the brief time you have been working). Keeping the emulsion warm seems to keep the chemicals in solution, rather than precipitating out, and makes the emulsion speedier when exposed.

Making a Cyanotype

1

Preparing the materials

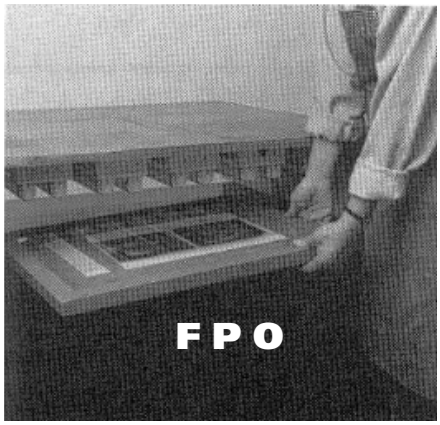
Shake each bottle of solution, then mix 1 oz (29.5 ml) of A and 1 oz of B together to coat eight 8 × 10 in. (20.25 × 25.5 cm) sheets of paper.



2

Coating the paper

Dip a brush in the mixture and apply a small amount to the paper, moving the same solution around so as to avoid saturating one area. Coat beyond the image area or coat an extra swatch of test paper so you can watch the change in color during the exposure. It should now appear yellow-green. Use a hair dryer on the cool setting, air dry flat, or hang the paper in a dark room to create drip patterns as the emulsion dries.

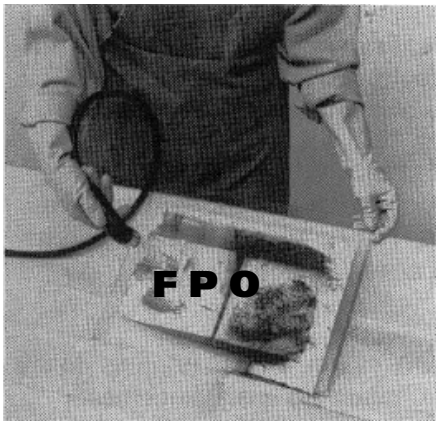


3

Exposing the print

Place the paper, coated side up, on a backing board and then position the negative, correct-reading, on the emulsion. Lay this unit under glass.

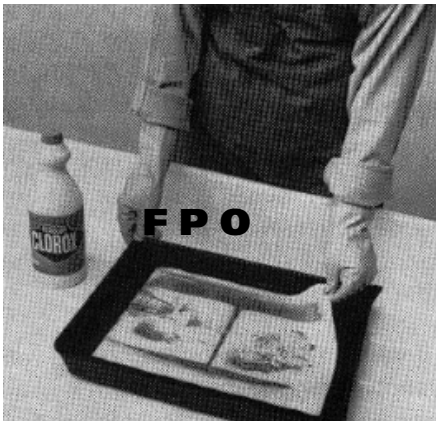
Place the loaded print frame in direct sunlight or under artificial ultraviolet light for 5 to 20 minutes. As the emulsion is exposed, the cyanotype will turn from yellow-green to blue-green to iridescent blue. Or expose until the highlights of the print have more tone than you want.



4

Developing the print

Remove the paper and prop it on a piece of Plexiglas angled in a sink. Hose the paper with water, or rock it in a tray of water, which you must change frequently. I use the hose first, then the tray. No yellow should remain on the paper, and the water eventually should run clear.



5

Intensifying the print (optional)

Rock the print *for a few seconds* in a tray containing a solution of 2 capfuls of bleach or 2 oz (59 ml) of 3% hydrogen peroxide in 32 oz (1 L) of water, until the image turns a deeper blue.

6

Washing the print

Use the siphon or tub method to wash the print for 10 minutes. Then gently blot excess water with a clean, soft sponge and either air dry the print on a rack, hang it from a clothesline, or use a hair dryer or fan.

Tips *(cont.)*

■ For even richer blues, try double coating: apply a thin first layer of emulsion, dry it almost completely, and then apply a second thin coating.

■ Rinse and dry the brush as soon as you finish coating the paper.

■ Be sure the emulsion is completely dry before exposure, or negatives can be damaged and the finished print will show purple stains.

■ If you do not use glass, you can lay plants or objects on wet emulsion. The objects will pick up blue color, so use objects that are disposable. The emulsion dries during a 5- to 15-minute exposure in 70°F (21°C) to 85°F (29°C) weather.

■ Uneven application of the solution will cause streaks in the print.

■ If you hang coated paper or fabric to dry on a clothesline, wash the clothespins and line before the next use or you may stain future pieces with contaminated solution.

■ Mixed cyanotype solutions A and B last only 1 day uncovered. Blueprints/Printables keeps mixed A and B solution for months in a porcelain tub covered with black plastic. Precoated paper will keep for a few days if stored in a light-tight box, and for months in a light- and air-tight bag. You can tell if the emulsion has started to go bad by observing the coating before exposure; it should be yellow-green.

■ If you use a standard print frame, unhinge a portion of the back and, without moving the negative, check highlights of the print for color changes. Exposure is judged visually. With a thin (more transparent) negative, remove the paper at the blue-green stage; with a dense (black) negative, the paper should be iridescent blue-violet.

■ If the print is too blue, leave it in the intensification bath to reduce the pale blue tint in the highlights. If the print is too pale, increase exposure time, decrease intensification time, or further dilute the intensification bath.

■ If you are combining cyanotype with brown, casein, or gum printing, do the cyanotype first or the blueprint will alter or obscure the image underneath because potassium ferricyanide is a photographic bleach. If you, being of an experimental nature, still choose to blueprint second, eliminate the bleach intensifier. Remember that fixer, which you have to use with the brown print, can slightly bleach a blueprint. Cyanotype works beautifully over palladium prints.

■ Apply a solution of ¼ oz (5 g) oxalic acid with 3¼ oz (100 ml) water as an after treatment to clear white areas of residual blue. See the Safety section of Chapter 10 for information regarding handling oxalic acid.

■ To remove lavender stains, try rewashing the print well and letting it dry. Often the lavender fades. If not, squirt a small amount of liquid hand soap, such as Ivory, Palmolive, or Dove in a clean tray. Add water. Swish the print for a few minutes or up to an hour for fabric. Wash in plain water afterward.

■ If you do not wash the print enough, the white areas may turn blue while drying or form a darker blue puddle.

Cyanotype on Fabric

In addition to the previous tips given in this chapter, the following tips are useful when printing cyanotypes on fabric.

Tips

■ Sometimes you can remove purple stains in fabric by washing it again in ½ teaspoon (2.5 ml) liquid soap, such as Ivory, Woolite, or Lux, and 1 gal (3.8 L) water. Rinse well afterward. Powdered, biodegradable soaps are not recommended.

■ Fabric should be stretched to pull out wrinkles during coating. Like paper, it can be coated lightly with a brush. If dipped into a tray of solution, fabric will take longer to dry thoroughly.

■ Fabric artist Eliza Proctor advises not to air dry the freshly coated emulsion on humid days and nights, or you may get a mottled print.

■ For more detail in the finished piece, use a warm—not hot—iron on the back of the coated fabric before exposure, and use plate glass during the exposure; this way your negative will be in closer contact with the coating.

■ Sandra Sider, in an article entitled "Blues in the Light: Cyanotype on Fabric" in *Fiber Arts* (Sept/Oct 1986), notes that cyanotypes impart an iron stain to the fabric that is permanent. "Even though cyanotypes might fade somewhat in ultraviolet light, the intensity of the blue can be revivified by storing the piece away from light for a short period of time" (a couple of hours to a couple of weeks).

■ Blueprinted fabric pieces can be dry cleaned. Avoid detergents and soaps with chlorine bleach or borax. Baking soda and soda in washing products or underarm deodorants will cause the blue to turn yellow. Powdered soap does not dissolve properly, creating spots on the fabric wherever granules touch the wet blueprint. Residue in and on washing machines where powdered soap is used also will affect the blueprint.

■ Washing blueprinted fabric will restore the blue color, but it is usually less intense. Use Spray 'n Wash, K2R, or Rit Grease & Stain Remover #90.

■ Blueprint/Printables supplies precoated T-shirts, cotton and silk by the yard, and 8½ in. square quilt pieces. You can also send them your fabric to coat.

Toning Cyanotypes

Cyanotypes can be toned to other colors. Make a dark cyanotype and let it dry. Later, presoak it in water and sponge excess water off it. Either pour the toning formulas into trays and bathe the print until you get the color you want,

Toning Cyanotypes *(cont.)*

or apply the solution with a brush to selected areas. Once the mixture becomes exhausted and no longer affects the print, discard it and mix fresh toner. Wash the print carefully after toning. Most of the necessary chemicals are available through Photographer's Formulary.

For a gray to reddish tone, dissolve 1/6 oz (4.8 g) copper nitrate in 3.3 oz (96 ml) distilled water, then add 5 to 7 drops household ammonia.

For brown to black tones, add 1/3 oz (10 ml) ammonium hydroxide to 3 1/3 oz (100 ml) distilled water in one tray. (Alternatively, you can use the yellow-tone recipe below to bleach the color out.) In another tray, combine a little more than 1/3 oz (10 g) tannic acid, available at a pharmacy or wine-making store, with 17 oz (500 ml) distilled water. You can also obtain tannic acid by seeping 10 pekoe tea bags in 2 cups (0.5 L) water. Immerse the cyanotype in the first solution until it practically disappears, then put it in the second bath until you achieve the desired color.

Judy Siegel (editor of the *World Journal of Post-Factory Photography*) recommends this alternate formula for brown or black tones: Add 1 tsp or more tannic acid to 1 qt (0.95 L) water in a tray. In another tray, add 2 tsp sodium carbonate to 1 qt (1000 cc) water. Immerse the cyanotype in the first bath for 2 minutes, then rinse it and put it in the second bath. Rinse it again and put the print back in the first bath. Continue in this manner until you achieve the desired tone.

For yellow tone, Barbara Hewitt (of Blueprints/Printables) recommends dissolving 1 Tbsp trisodium phosphate from a hardware store in 1 qt (0.95 L) water. I have also used a weak solution of chlorine bleach from a grocery store to achieve the same effect.

Search for more recipes online at http://duke.usask.ca. Or, consult the directions in *Modern Heliographic Processes, Photo Art Processes, The Keepers of Light,* and *Handbook of Alternative Photographic Processes,* listed in this book's Bibliography.

Chapter 7 VAN DYKE BROWN PRINTS

A brown print can be made on paper or fabric and can yield permanent images rich in detail, ranging from pale to deep Van Dyke brown. A photographic negative, when placed in contact with the silver-based emulsion, produces a positive picture after relatively short exposure to daylight or ultraviolet light. The longer the exposure, the darker the brown of the print. A brown print also reacts positively to such toners as Kodak Polytoner, gold selenium, sepia, Berg Copper, and Berg Blue (see Chapter 3, Toning) to produce purples, pinks, and blues. Brown printing, which is a relatively expensive process because of the cost of silver nitrate (one of its component chemicals), can be combined with other techniques described in this book and with traditional artists' materials such as paint and pastels.

William Henry Fox Talbot, who based his experiments on the work of earlier pioneers in photography, is considered the originator of photographic printmaking.[1] His 1839 discovery of "the process by which natural objects may be made to delineate themselves without the aid of the artists pencil" (Talbot's words), is closely related to Van Dyke brown printing. Talbot coated paper with a solution of silver nitrate, and Sir John Herschel, inventor of the cyanotype process (see Chapter 6) suggested that Talbot make the images permanent by fixing them in a bath of sodium thiosulfate (still a component in today's fixer). Talbot devoted himself to photography and struggled with the art for years. Many historians consider Talbot one of the inventors of photography because he formulated the Talbotype process to make negatives and print them as repeatable (rather than one-of-a-kind) positives on paper and discovered how to strengthen these prints chemically from indistinct images to clear and subtle renderings. His Reading Establishment, pictured on pages 108 and 109, was the first commercial photo studio in the world. Romain Talbot is credited, a few years later, with being the first to produce a practical method for copying architectural and engineering drawings onto paper sensitized with silver salts.

Safety

Silver nitrate in crystal or solution form is destructive to the skin, mucous membranes, and eyes, so wear neoprene gloves and goggles, and handle the chemical with care. In case of skin contact, flush the area with water and then wash with soap and water. If silver nitrate gets in the eyes, seek medical attention immediately.

Do not inhale silver nitrate dust. Wear a mask with a dust filter both when mixing and when drying Van Dyke brown emulsion.

[1]Crawford, William. *The Keepers of Light. A History and Working Guide to Early Photographic Processes.* Dobbs Ferry, NY: Morgan and Morgan, 1979, p. 16.

Panorama of William H. F. Talbot's Reading Establishment, showing the copying of paintings, photographic portraiture, the printing of negatives, and the photographing of sculpture. Talbot is in the middle removing the lens cap. (Courtesy Trustees of the Science Museum, London.)

If you get brown stains on your skin, let them wear off.

Silver nitrate can supply oxygen to a fire. Clean up spilled silver nitrate with water and dispose of excess down the drain, not in a wastepaper basket.

If ferric ammonium citrate comes in contact with heat higher than 300°F (147°C) or concentrated acids, such as stop bath, a poisonous hydrogen cyanide gas will be released. Therefore, long exposures to ultraviolet light should not be done with sunlamps. Ferric ammonium citrate is slightly toxic, so wear protective gloves at all times and a protective mask when handling the powder form. Never mix ammonia products with bleach, since the combination produces lethal fumes.

Most fire departments want to know the location and types of chemicals stored in your home.

Never ingest chemicals.

Clearly label bottles and keep them out of the reach of children and pets. Brown print solution can be fatal if swallowed.

Dispose of excess chemicals by washing them down a drain with large volumes of water.

Old fixer or hypo solution produces highly toxic sulfur dioxide gas, so discard fixer that no longer is clear in color.

Method Overview

1 Brown print solution, containing silver nitrate and ferric salts, is mixed, coated onto paper or fabric, and dried in subdued light.

2 An enlarged negative or object is placed on top of the coated surface. Light shines through the clearer parts of the negative or around the object and hits the coating, reducing some of the ferric salts to the ferrous state.

Method Overview *(cont.)*

3 The negative is removed, and the exposed paper or fabric is washed in water, where the ferrous salts reduce the silver nitrate to metallic silver, visible as a positive brown image. The print is fixed in a chemical bath, and washed again to produce a Van Dyke brown print.

Materials

More detailed descriptions of materials are given in Chapter 4, Creating the Photo-Printmaking Studio.

1 Image. To make a positive image rich in detail, either use a negative transparency the same size as the positive you wish to create or use real objects. Brown printing will render a wide range of tones.

2 Chemicals. You will need 1 oz (30 g) silver nitrate crystal, ½ c (90 g) ferric ammonium citrate (green anhydrous), and 1 Tbsp (15 g) tartaric acid; all are special-order items from one of the suppliers listed at the end of this book. Fixer (hypo) is available at photography stores, as is hypo eliminator, which decreases the final wash time. Store chemicals in tightly capped bottles in a dry place.

Bostick & Sullivan (see Supply Sources) makes premixed brown print solution. Photographer's Formulary (see Supply Sources) packages a kit with all the components, which is helpful in case you want to try this method without investing in quantities of chemicals or if you need to make only a few prints.

3 Distilled water. Sometimes you can get by with tap water for making the brown print solution, but the use of distilled water prevents the frustration of possibly mixing bad solution. A dish tub filled with hot water can be used to warm up the distilled water.

4 Receiver. Finished prints should be made on rag paper of medium absorbency, but practice prints can be made on less-expensive paper. I particularly like Rives BFK. The Photographer's Formulary suggests Crane's Kid Finish AS8111. I have printed Van Dyke on the spun plastic of Tyvek by coating lightly with a sponge brush, working the emulsion in evenly with a dry sponge brush, and overexposing it. Natural fabrics, such as a close weave cotton, accept the brown print solution best and yield the deepest tones, but brown printing can be done on synthetic fabrics as well. Avoid permanent-press cloth, which repels the solution. It is easier to learn the technique on paper before you apply it to fabric. See the Materials section of Chapter 6, Cyanotypes, for more details (page 99).

5 Sizing. Different sizings can affect the color of the final print, so experiment with the methods described in Chapter 4, but definitely size the paper evenly first or you may end up with uneven stains on your print. I use the spray starch sizing method, page 57, for BFK. Uneven sizing can cause blotchy prints. Wash out the manufacturer's sizing before printing on fabric.

6 Ultraviolet light. If you have built an exposure unit as described in this book, you probably will need 10-minute exposures. Sunlight is also suitable. Mix and coat chemicals in subdued light or under a safelight.

7 Applicators. Soft house painting brushes, polyfoam brushes 1 in. (2.5 cm) or more wide, Hake brushes, or Blanchard brushes (see page 58) provide useful

tools for coating the solution. You can dip paper into the solution by pouring a small amount in a glass or porcelain baking pan, which you tilt at a 45° angle. If you use an applicator with metal parts, keep the metal out of the solution, or coat the metal with clear nail polish.

8 Printing frame. To achieve good contact between the negative or flat object and the emulsion, use plate glass with another sheet of glass or Masonite underneath, or follow the instructions on page 43 for building a frame. You will be ensuring that the imagery is not blurry. Make sure the glass is clean and dry before each use. Foreign particles lodged in the glass can create dimples in the print.

9 Brown bottle. A glass quart (1 L) fruit juice jar or recycled chemical bottle, thoroughly washed and labeled as to contents and date mixed, is fine for storing the chemicals. Use glass if you can, because glass does not absorb the liquid chemicals, and it also enables you to see if any of them precipitates. You can even use a clear glass bottle if you carefully enclose it in an opaque bag, such as the plastic ones in which photographic paper and film are wrapped. Store liquid chemicals in a tightly capped container in a cool, dry area. Be careful to stir, not shake, the bottle, because if it has a metal top it will eventually corrode from the chemicals.

10 Four nonmetallic trays or tubs. You will need photo trays or dish tubs larger than the print when you first wash the print, fix the image, remove the fixer, and finally wash the image. One tray can double as a container for hot water to heat up the distilled water while making the stock solution.

11 Siphon washer. This gadget, available at photography stores, works well for washing prints when attached to a photo tray in a sink. Or you can drill small holes up the sides of a dish tub or photo tray and gently run water directly from a faucet over the back of the print. Both methods allow clean water to enter while contaminated water drains. Blot the print with a clean sponge afterward.

12 Sheet of glass or Plexiglas *(optional)*. Lay the exposed print onto a sheet of glass angled in a sink while you develop the image with running water. This system allows unexposed chemicals to drain off, preventing them from contaminating the print. Wrap masking or duct tape around the edges of the glass to prevent it from cutting you and to cushion the glass from breaking.

13 Beaker, stirring rod, funnel, cup. You will need nonmetallic implements, and the beaker should measure 32 oz (1 L).

14 Neoprene gloves, respirator with toxic dust filter.

15 Hair dryer, fan, clothesline and pins. Use a hair dryer on the cool setting or a fan to thoroughly dry the coating before laying a negative on top. A clothesline and pins can be used to dry finished prints.

16 Newspaper or oilcloth. Cover your work area because Van Dyke brown print solution stains and can contaminate other prints. Oilcloth is still available from the Vermont Country Store (see Supply Sources), and it's just like the stuff from the 1950s!

Tips

■ Store brown print solution in a cool, dry place, such as a refrigerator. If the container is tightly capped, the solution should last for months, even years.

■ Cut the recipe in half if you are not doing a great deal of printing.

■ Silver nitrate has a tendency to precipitate to the bottom, so stir the solution if it has been sitting (even during the brief time that you are working). I keep the mixture in warm water while I work, which seems to keep the particles suspended.

■ The intensity of the emulsion increases if the emulsion ages from 1 to 7 days after you mix it.

Making the Solution

Equipment You Will Need

Silver nitrate

Ferric ammonium citrate

Tartaric acid

Distilled water

Label

Brown bottle

Beaker

Funnel

Stirring rod

Thermometer

Tub

Neoprene gloves, respirator with toxic dust filter

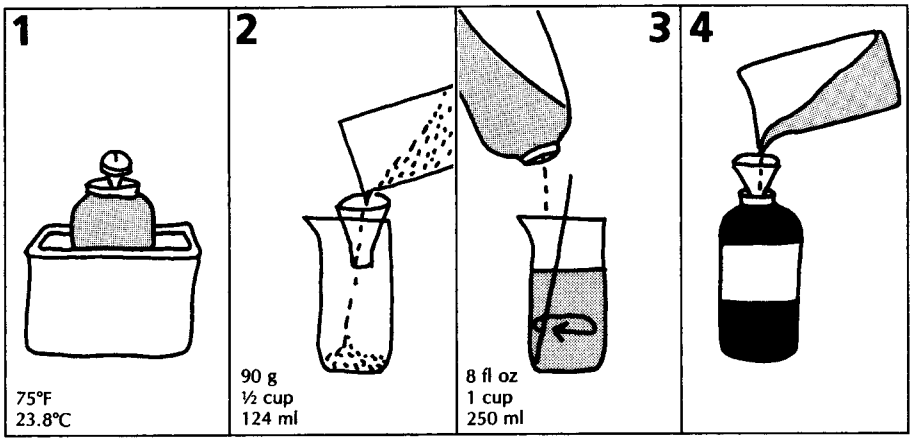
Procedure

1. Adjust water temperature to 75°F (23.8°C).

2. Using a funnel, pour 90 g (124 ml) ferric ammonium citrate into a beaker.

3. With constant stirring, add water to make 8 fl oz (250 ml).

4. Pour this solution into a labeled brown bottle.

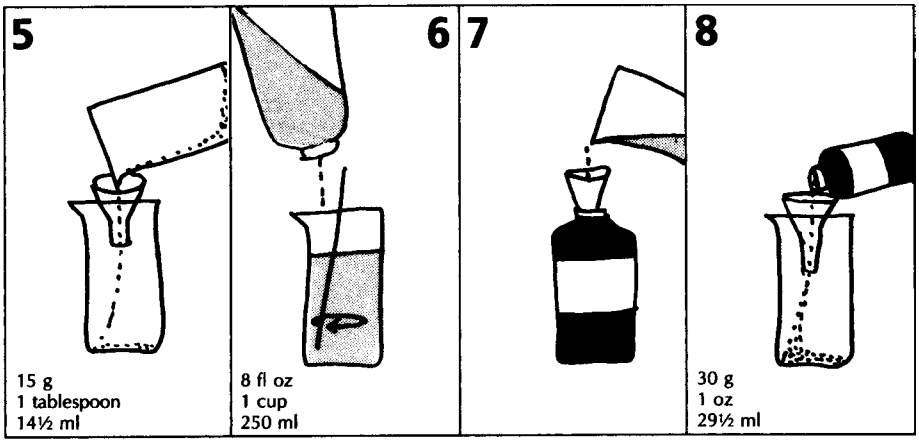


5. Pour 15 g (14.5 ml) tartaric acid into beaker.

6. With constant stirring, add water to make 8 fl oz (250 ml).

7. Add this mixture to the brown bottle containing the ferric ammonium citrate solution.

8. Pour 30 g (29.5 ml) silver nitrate into the beaker.

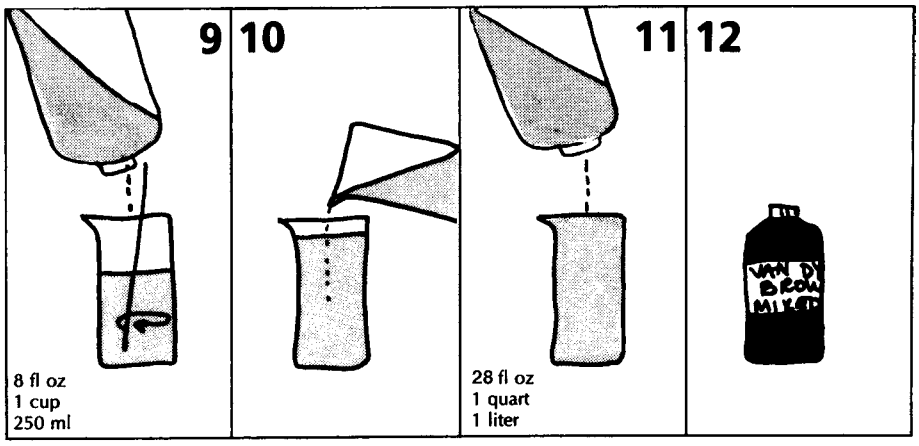


9. With constant stirring, add water to make 8 fl oz (250 ml).

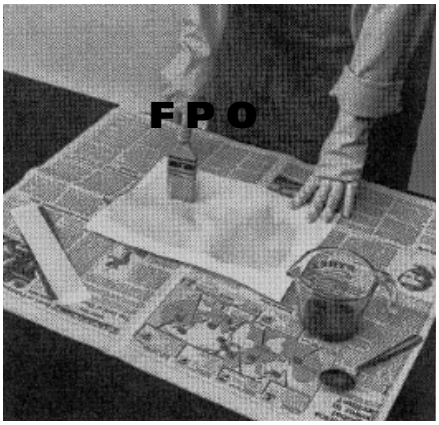
10. Pour the mixture from the bottle containing the ferric ammonium citrate and tartaric acid solution into the beaker.

11. Add enough water to make 28 fl oz (0.8 L). (For bright sunlight, make 32 fl oz or 1 L.)

12. Pour the contents of the beaker into the brown bottle. Cover the bottle and shake the solution to ensure thorough mixing of chemicals.



Making a Brown Print



1

Coating the paper

Shake the bottle of solution and pour 1 oz (29.5 ml) into a glass cup. Dip the end of a brush into the emulsion and apply it to the paper, moving the solution around so as to avoid saturating one area. Coat beyond the image or coat an additional small piece of scrap paper.

Use a fan or a hair dryer on a cool setting to dry the paper, or dry the emulsion flat, or hang the paper from a clothesline in a dark, clean area. Make sure that the coating is yellow; if it appears brown, it has gone bad. Make a sandwich with a board on bottom, the emulsion side of the paper facing up, the negative positioned so it reads correctly, and clean glass on top.

2

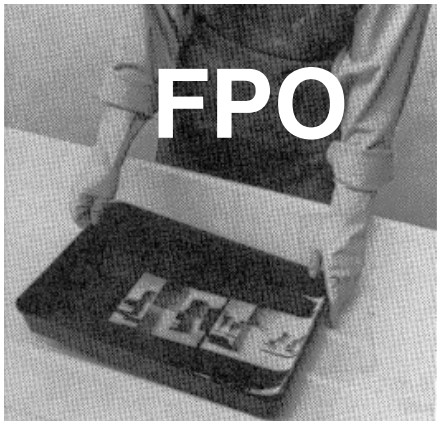
Exposing the print

Place the loaded print frame in direct sunlight for 3 to 10 minutes, or under artificial ultraviolet light 6 in. (15.25 cm) away for 8 to 14 minutes. Either watch for brown detail in the middle tones and yellow-brown in the highlights, or watch the scrap paper turn from yellow to tan to brown.

3

Developing the paper

Remove the paper and spray wash it until the cool, running water is clear, then follow with a tray wash (approximately 5 minutes).



4

Fixing the print

Mix fixer according to the manufacturer's recommendation for photo paper, then dilute it further by combining in a tray 2 oz (59 ml) of this stock solution with 32 oz (1 L) of water. Immerse the print for 5 minutes; this will darken the image and make it permanent.

5

Removing the fixer

Dilute the hypo eliminator according to the manufacturer's recommendation for photo paper, pour it into a tray, and immerse the paper for the suggested amount of time. Rock the tray.

6

Finishing the print

Water-wash the print for 20 minutes in a tray fitted with a siphon, or change the water frequently. Then blot excess water with a soft, clean sponge and dry in a clean area on racks or a clothesline.

Tips

■ If you coat blue or gum over brown printing, the bleach you use as intensifier for blueprinting and the dichromate sensitizer in gum solution will fade the brown print. If you use hydrogen peroxide as an intensifier with cyanotypes, it does not affect the brown print. Keep in mind that the potassium ferricyanide in blueprints is a photographic bleach, so any place where it is applied will eliminate the brown print under it, but you will see a real hard edge between

the blue and the brown. In addition, you can start with a very dark (overexposed) brown print, or do the brown printing last. Artist Bill Durgin purposely underexposes a cyanotype, then prints the same negative in Van Dyke brown over it, resulting in brown prints that are a deeper brown. Remember that rag paper is not dimensionally stable, so that if you put one process on another, you must preshrink the paper, which can be accomplished when you size the paper.

■ Do not use utensils from other processes with brown printing, or you can contaminate the emulsion.

■ A little sensitizer solution goes a long way: 1 teaspoon (5 ml) will coat an 8 × 10 in. (20.25 × 25.5 cm) sheet of paper. Overly saturated paper makes for longer exposures.

■ Be sure the emulsion is completely dry before exposure, or negatives can be damaged and the finished print will show black stains. Rinse and dry your brush as soon as you finish coating the paper.

■ If you hang coated paper or fabric to dry on a clothesline, wash the clothespins and line before the next use or you may stain future pieces with contaminated solution.

■ If you use a standard print frame, unhinge a portion of the back and check one corner of the print for color changes without moving the negative. Exposure is judged visually. With a thin (more transparent) negative, remove the paper at the tan-brown stage; with a dense (black) negative, remove the paper when it turns deep silvery brown.

■ Photographer's Formulary sells potassium dichromate for contrast control (decreasing the middle tones). Approximately 9 to 10 drops of a 10% dichromate solution is added to a 500 ml first wash of water for this technique. A 10% solution is made by taking 1 oz of water and slowly stirring in the dichromate until no more can be absorbed and the crystal begins to precipitate out. Then add 9 oz more water. Because potassium dichromate is toxic, it is recommended that you mix the solution in a sink and wash all the utensils immediately after use. I recommend neoprene gloves. Dispose of excess dichromate with copious amounts of water down a drain, not in a wastepaper basket. If you want to get rid of any quantity of dichromate, take it to a hazardous waste center; it is one of the worst-polluting chemicals.

■ If the print is too pale, increase the exposure or use more transparent negatives. Wait until the print dries, however, or dry it with a hair dryer, because prints appear much lighter when wet.

■ If the print is overexposed, so that the highlights are blocked up and the brown is too dark, leave the print in the fixer longer than recommended until it comes back to the color you want. Make sure you remove the fixer afterward and *thoroughly* wash the print.

■ To remove wrinkles, dampen the back of your dry print with a slightly damp sponge, place the print face down in a hot (375°F or 191°C) dry mount press, or press the print with an iron on the cotton/linen setting. This procedure will darken the print, too.

Tips *(cont.)*

■ See Chapter 3 for instructions on toning finished brown prints to blue, yellow, copper, and silver, or consider using the Formulary Gold Toner to warm the brown color before you fix the brown print.

Tips for Brown Printing on Fabric

See the section Cyanotypes on Fabric in Chapter 6 for more information.

■ Like paper, the fabric can be coated lightly with a brush or dipped in a tray of solution, but thorough drying will take longer.

■ Do not air dry the freshly coated emulsion on humid days and nights, or you may get a mottled print.

■ For more detail in the finished piece, use a warm—not hot—iron on the back of the coated fabric before exposure; in this way, your negative will be in closer contact with the coating. You can also stretch the fabric to eliminate wrinkles. Use plate glass during the exposure.

■ Brown printed fabric can be washed in cool water with mild liquid soap, such as Ivory or Woolite. Avoid detergents and soaps with chlorine or borax.

■ Brown prints can be dry cleaned.

Chapter 8 GUM BICHROMATE PRINTS

Gum printing makes water-soluble pigments, such as gouache and watercolors, photographic, producing prints of subtle and wide-ranging colors on paper or fabric. Mixing gum arabic, paint, and a solution of ammonium or potassium bichromate as the light sensitizer, you can create a single or multicolored image ranging from continuous tone to high contrast. Gum printing also can be combined with traditional printmaking processes such as etching and drypoint, or with other photo-printmaking techniques from this book. Because the emulsion is delicate, patience and a willingness to experiment are essential.

One of the earliest photographic processes to be used as a personally expressive medium, *gum bichromate*—also known as *dichromate*—printing is credited to a Frenchman, Alphonse Louis Poitevin, whose experiments using pigments were based on tests with the light-sensitivity of dichromates by earlier inventors. The English photographer John Pouncy patented the technique in 1858. Not until 40 years later, with the exhibition of prints by Robert Demachy, was it recognized as a workable artists' medium. Simultaneously the American photographer Edward Steichen made multicolor gum prints, such as the one reproduced on page 118, combined with other photo-printmaking techniques. Gum printing lost its popularity after World War I, usurped by speedier methods, but many artists still find it a beautiful and rewarding process. Todd Walker, whose experimental photographic work has been influential in contemporary times, is one of the important figures in the rebirth of gum bichromate printing (see Plate VIII).

Until Spring of 2000, a closely related product, Kwik Print, was manufactured (See Preface).

Safety

Bichromates (dichromates) can cause skin inflammation, similar to an allergic reaction, upon repeated exposure. Wear protective gloves and goggles at all times when mixing and coating bichromate as well as when washing a bichromate-sensitized print. Wear a respirator with a toxic dust filter when handling bichromate crystals.

Store ammonium dichromate away from heat and combustible materials.

Bichromates can be poisonous when ingested, even in small quantities. Keep chemicals and chemically contaminated materials away from your mouth and out of the reach of children and pets. They are suspected carcinogens.

Dispose of excess solution or chemical by flushing it down the drain with a large volume of water, not in a wastepaper basket. Better yet—evaporate the excess, then take this much smaller quantity to a hazardous waste center.

Inhalation of gum arabic solution can cause asthma, so if you spray rather than brush on gum bichromate emulsion, use a respirator over your nose and mouth.

Edward Steichen, *Experiment in Multiple Gum,* 1904, 11⅛ × 9⁹⁄₁₆ in. (282 × 242 cm) gum bichromate print. (Courtesy of the Metropolitan Museum of Art, The Alfred Steiglitz Collection, 1933 [33.43.13].)

Certain paint pigments, such as emerald green, cobalt violet, true Naples yellow, all cadmium pigments, flake white, chrome yellow, manganese blue and violet, Verona brown or burnt umber, raw umber, Mars brown, lamp black, and vermillion, can lead to poisoning and other complications if they are ingested or inhaled frequently. Wearing a respirator, working in a ventilated area, and carefully washing your hands and cleaning your fingernails after using these pigments can prevent accidentally carrying them to the mouth and ingesting them.

Method Overview

1 Paper or fabric is sized and dried.

2 Under subdued light, the paper or fabric is coated with gum bichromate emulsion containing gum arabic, dichromate sensitizer, and pigment and then dried.

3 The coated surface is placed in contact with an object or negative, and ultraviolet light is shone through the negative. The emulsion hardens in the "positive" areas where light reaches it.

4 The negative is removed. The paper or fabric is developed in water, where unexposed areas of color are dissolved and washed off, leaving a reversed image to dry and harden.

5 One coating must dry before a new layer may be applied, exposed, and processed.

Materials

More detailed descriptions of materials are given in Chapter 4, Creating the Photo-Printmaking Studio.

1 Image. Low-density (no heavy black) and low-contrast negatives the size of your intended print offer the possibility of a full tonal range in one color after one exposure to gum bichromate emulsion. More often, though, the density of the negative exceeds the range of the emulsion, thus requiring multiple exposures to build up highlights, middle tones, and shadows. Posterized and color separation negatives, described on page 79, offer versatility, because you can create a multiplicity of colors from only three colors. In addition, high-contrast negatives work quite well. I recently tried printing a low-contrast negative in alizarin crimson over a print in a dark green from a high-contrast negative of the same image. The results yielded a range of colors after just two exposures. To ensure that all negatives are exactly the same size, you need to make them during the same darkroom session, using a continuous-tone developer for the low-contrast negative and using lith A and B developer for the high-contrast negative (see chart, page 63). Try stencils, found objects, torn paper, lace, drawings, and photocopies on acetate. To get more than one layer of color, register negatives as described later in this chapter or in Chapter 4.

You can make color separations on a computer or with a large-format camera, and they can be used without enlarging to create multiple colored gum prints. Elaine O'Neil, who made the fabulous brown print quilt shown in Plate VII, explains how to make color separations in *Instant Projects* (listed in the Bibliography), from which the following instructions are paraphrased:

Materials *(cont.)*

First set up a still life or select a scene that will not change between exposures. Include a color control patch and a gray scale, available from a good photo shop. Position the patches and scale at the edge of the film format so that you can later trim them off. Or, make two sets of negatives, one with and one without the patches and gray scale. Next, determine a basic exposure for the scene and expose film accordingly. If you use a Polaroid back and Polaroid film you can examine the gray scale in the negative; it should have good separation in both shadows and highlights. Adjust the exposure if necessary.

Make three additional exposures, increasing the basic exposure as indicated here if the illumination is from daylight or electronic flash. When you are exposing through a #47B blue filter, add 2⅔ stops. Through a #58 green filter, add 3 stops. Through a #25 red filter, add 3 stops. With tungsten illumination, which is richer in red light, increase the red filter exposure only 2 stops. These filters are special-order items from a photography store. As soon as you peel the Polaroid film from the negative, clip the corners of the negatives so that you can identify them after clearing (e.g., clip one corner for the blue-filtered negative, two corners for green, and three corners for red).

Evaluate the exposure of the negatives by examining only the middle value (18% gray card, or Zone 5 on the gray scale). It should be the same density in all three negatives. If the value is not the same, adjust the exposure and reshoot. The color areas in the scene will change in density depending on the color of the filter. Clear the negatives as Polaroid instructs. With a tricolor process, the blue-filtered negative will be used to print the yellow emulsion layer, the green-filtered negative will print the magenta layer, and the red-filtered negative will print the cyan layer.

The unfiltered negative is used only to check exposure, although I sometimes use it to print a first layer of underexposed black or Paynes gray so I can see succeeding layers for registration.

2 Chemicals. You will need premixed gum arabic 14° Baume, available usually in 1-gallon (3.8 L) jugs from offset lithography and commercial printing suppliers. In addition, small quantities—enough to last for a few print sessions—are sold in art stores under the names Winsor & Newton or Grumbacher gum arabic for oil painting and from Photographer's Formulary. Although gum arabic is available and less expensive as a powder, it is time-consuming and more of a health risk to mix.

I have heard of a 20% solution of 88% hydrolised PVA (polyvinyl alcohol without vinyl acetate) and water being used instead of gum arabic. After letting the mixture stand for 20 minutes, it is heated to no higher than 122°F (50°C) with continuous stirring, at which point the PVA should appear clear. Any undissolved grains can be strained through a double layer of cheesecloth in a funnel. Incidentally, a form of this PVA method with ammonium dichromate is used as a photo ceramic technique on bisque ware and as an emulsion for photo silkscreen.

You will also need either potassium or ammonium bichromate, which can be purchased as a dry crystal in 1 lb (0.5 kg) or smaller bottles from suppliers listed in the back of this book. Ammonium bichromate is preferred for its greater sensitivity to ultraviolet light.

Proper mixture, exposure, and development should avoid staining problems, but a bath of 5% potassium alum and distilled water may help clear the print.

This bath also hardens the gum emulsion, a result especially useful with multiple coatings. Some gum printers use a 10% solution of potassium metabisulfite or sodium bisulfite for 5 minutes. Clear the prints individually, because the emulsion is quite delicate and you will want to watch the action on each one.

3 Pigments. Professional or artist-grade watercolors or gouache in tubes work best. The quality of the pigment, as well as the color, can make a difference if you want to avoid staining on your paper. Watercolors produce more transparent coatings, whereas gouache renders more opaque layers. Liquid tempera colors have been used with success, but they tend to separate into fine particles, producing a grainier look in the gum bichromate print. Make sure that the pigment you use has no chromium in it (such as chrome yellow) because it reacts negatively with the bichromate.

Alizarin crimson, cadmium yellow light, and thalo blue approximate the three primary printers' colors for use with color separation negatives. Cerulean blue seems to be difficult to use.

4 Distilled water. Sometimes tap water is fine for making the bichromate solution, but distilled water eliminates the frustration of possibly mixing bad solution. A tub filled with hot water can be used for warming the distilled water.

5 Receiver and sizing. Finished prints should be rendered on rag paper with a slightly toothy texture and medium absorbency, such as Strathmore Artists Print paper or Lana. Smooth papers, such as Rives BFK and Somerset Satin, or the backs of the toothier papers (even the backs of reject prints) can be used for higher-contrast work. Practice prints can be made on less-expensive paper. Some gum printers use white or other pigments lightened with white on dark paper. BFK, which comes in black and dark brown, is particularly suited to this dramatic approach. Or you can brush cyanotype or brown print solution on paper, expose it to ultraviolet light without a negative, process the paper, and get a sheet of solid blue or brown paper.

Unless you use the diluted acrylic polymer size by itself, all paper should be sized (see page 57) with a method that uses hot water because you will also be preshrinking the paper, an important preparation for applying more than one gum print coating. Otherwise, you need to preshrink paper by floating it for 20 minutes in 104°F (40°C) water, then hanging it without weighting it to dry, or drying it flat on clean screens. In an article entitled "The Gum Print" in *Darkroom Photography* (October 1986), James R. Collins suggests the following method for preshinking:

> Size the paper, then air dry it. Apply the gum bichromate emulsion to an area about 1 in. (2.5 cm) larger on all sides than the image, and hang the paper in front of a cold-air fan to dry. After a few minutes, when the emulsion is just barely tacky to the touch, put two pencil dots 12 in. (30.5 cm) apart and about 1/8 in. (5 mm) inside the emulsion edge. Hold a hair dryer about a foot (30.5 cm) from the paper, and evenly blow warm air over the paper until it has shrunk the paper by 1/8 in. (5 mm) and the pencil dots measure 11 7/8 in. (30.25 cm) apart. Make the exposure, develop the image, and repeat this coating and preshrinking procedure with each application of emulsion.

Materials *(cont.)*

My personal routine is first to use the alum and spray starch sizing method described on page 57, then to size with acrylic matte medium diluted with 9 parts water, building up three layers in alternating directions. You can even tint this diluted size with acrylic paint if you want a pale color to work on. In addition, I use one layer of dilute polymer medium—not combined with acrylic paint—between each gum print layer to prevent light areas from staining. You can finish a print with gloss medium over the last color to make an even glossier appearance than the gum arabic in the formula already provides.

Because sizing paper and fabric is necessary, messy, and time-consuming, you will find it more practical to size several pieces of paper or fabric at once. Size the side to which you apply the emulsion. The other sizing methods (see pages 57–58) work for numerous coatings, but be aware that the highlights become tinted with pigment. The acrylic polymer medium method (page 58) works best for up to four gum print layers. My students have found that if you alter the instructions by mixing 1 part polymer medium with 8 parts water, you can build up more layers and keep the highlight areas bright, but the paper eventually becomes stiff. Therefore, rather than use size, another student has experimented by using white gouache, which is more opaque than watercolors, for the first coating, and exposing it without a transparency. She then proceeded with normal gum printing.

Other surfaces that work are those with a tooth, such as the dull side of unused aluminum lithography plates, the matte side of frosted acetate, sandblasted glass and plastic, and roughed up metals.

Preshrunk and sized natural fabrics, such as cotton, canvas, and linen, can be used with gum bichromate printing. Practice first on paper, since imaging on cloth is a technically challenging way to work.

6 Ultraviolet light. You cannot see a great color change after exposure and before development with gum printing, unlike with cyanotype or Van Dyke brown printing. Artificial light such as sunlamps, photofloods, or fluorescent ultraviolet tubes allow the exposure to be exactly timed. However, indirect sunlight can be used; avoid direct sunlight because bright radiant heat output can cause the emulsion to fog with exposures over 5 minutes.

7 Applicators. Try fine flat bristle brushes or nylon paintbrushes about 1 in. (2.5 cm) or more wide. A sponge brush or foam paint roller from the hardware store is a good alternative. If you use an atomizer or air brush to apply the emulsion, be sure to wear a respirator and work in a well-ventilated area. A dry Blanchard brush (see Chapter 4) or a second foam paintbrush helps blend in and buff the strokes made by the coating brush. A small soft brush comes in handy for coaxing the development of the print in water. Keep the metal part of the brush away from the bichromate or coat it with clear nail polish.

8 Brown bottle. A clean, recycled fruit juice jar (optional, in case the recipe is doubled or tripled).

9 Printing frame. Use glass with Masonite, another piece of glass, or foam core backing, or follow the instructions on pages 43–45 for building a frame.

10 Two trays or tubs. You will need glass or porcelain trays larger than the print when you develop the image and fix it. You may also want a third tray

for a stain-remover bath, and a fourth pan of hot water to keep the bichromate solution warm.

11 A 4 oz (114 cc) measuring cup or measuring spoons, paper cups or a shallow glass bowl, stirring rod, and opaque 35 mm film canister or pill containers. The small, clear-plastic 1 oz (30 ml) medicine measuring cups available at a pharmacy or measuring spoons are helpful. A shallow glass bowl, such as a clear pudding dish found in a grocery store, is helpful because you can place it on top of a ruler in order to measure the length of the link of pigment. Avoid using stirring rods that can break or chip. *Wash all equipment, including brushes, in water after each layer.* Are you glad to finally find a use for those empty film and pill containers? They are perfect for storing the mixed gum bichromate solution because they are light-tight and spill-proof.

12 Timer, watch, or clock.

13 Household bleach *(optional)*. Severe overexposure causes pigment stains that can be removed by adding a few drops of laundry bleach to the first water bath. You can also use this bleach and water mixture with Webril Wipes to clean up borders after you finish printing. Selective areas can be lightened with a sharp typewriter eraser applied gently on a dry print.

14 Protective gloves, respirator mask.

15 Two registration pins, masking sheets, masking tape, ½ in. (1.25 cm) wide heavy black tape, ruler, hole punch, scissors, stencil knife (*optional*). Gum bichromate printing yields subtle colors, and usually one coating with one exposure is not enough. If you are using more than one negative with multiple coatings and exposures, see Chapter 4, Creating the Photo-Printmaking Studio, which describes a tried and true registration system (see pages 54–55) using registration pins and a hole punch of the same diameter. Another option that ensures image alignment while using the same negative with multiple coatings and exposures requires cutting four strips of heavy black tape 1 in. (2.5 cm) long. Affix a tape strip to the center of each edge of the same negative, beyond the image area. Trim the excess so that the tape is flush with the negative, and with a sharp hole punch make a half-circle notch in each of the taped edges. If you coat the paper with gum bichromate emulsion beyond the image area, as described under item 5 on page 121, the hole punch method will provide a dark half-circle on every side of the print after exposure. You can line up the notches in your negative with these half-circles for subsequent exposures.

A method that Richard Sullivan, of Bostick & Sullivan (see Supply Sources), recommends requires cutting a piece of Formica several inches larger than the paper, and obtaining registration pins, Berkeley or other registration tabs (self-sticking 1 in. square Mylar with a hole punched in one end), and double-backed carpet tape. He suggests taking your paper and dry mounting it to the center of the Formica or heat-resistant plastic. Degrease one edge of the board next to the paper with isopropyl alcohol. Cut a piece of carpet tape a little larger than the registration pin and stick it to the pin, and then stick the unit onto the degreased Formica next to the paper. Repeat this process with the other pin and stick it a few inches from the first pin on the degreased margin of the board. Next take each of the registration tabs and put them onto the registration pins with the sticky side up. Carefully attach the negative, emulsion

Making the Bichromate Solution

Equipment You Will Need

Ammonium bichromate crystals

Measuring cup

Stirring rod

Distilled water

Plastic film container or pill container

Paper cup

Thermometer

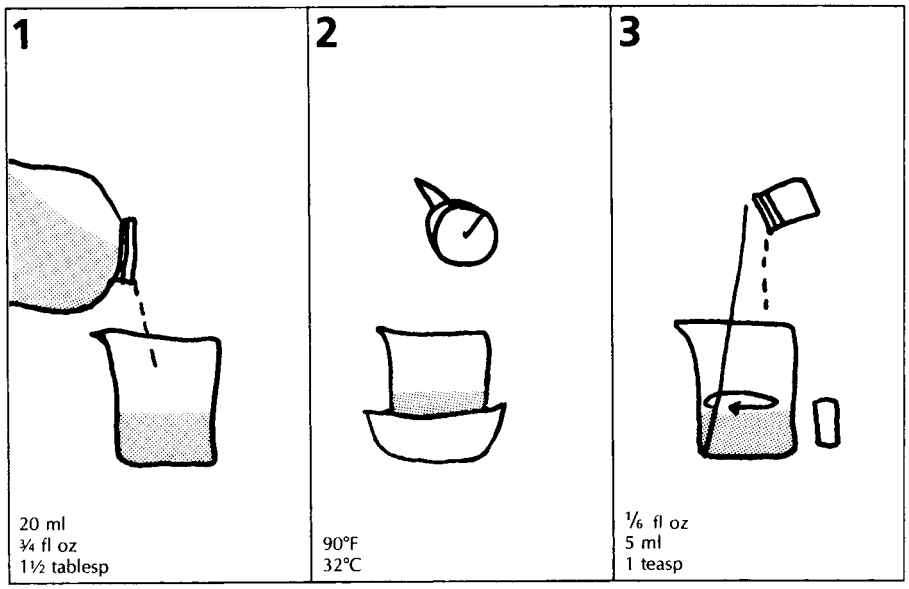
Tub of hot water

Neoprene gloves

Respirator mask with toxic dust filter

Procedure

1. Pour ¾ fl oz (20 ml) water into measuring cup.
2. Adjust water temperature to 90°F (32°C).
3. Measure and then pour ⅙ fl oz (5 ml) ammonium bichromate crystals into the measuring cup, stirring constantly.
4. Pour the bichromate solution into a film canister. Allow it to cool to room temperature.



Materials *(cont.)*

side up, to the sticky part of the tabs. You will use the negative emulsion side down, however. Remove the negative. Coat the paper with the gum bichromate solution, light on pigment, Sullivan advises, and underexpose it beneath the negative, which has been inserted onto the pins. Remove the negative. Process the paper still attached to the Formica, and build up layers, sizing and drying in between. When you are finished, stick the board and print in a hot dry mount press, quickly peel up one corner of the paper, and strip it off the Formica. You can reuse the board and pins.

16 Hair dryer.

17 Newspaper and kneadable eraser. Cover the work area with newspaper. Discard sheets as they become soiled. Use a kneaded eraser to pick up debris from the dried and unexposed emulsion layer.

Tip for Making the Bichromate Solution

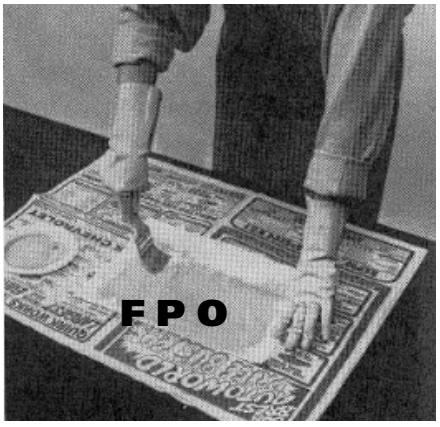
■ You can double or triple the provided recipe if you plan on doing a lot of printing, because the bichromate stock solution has an indefinite shelf life when stored in a cool, dark place. Should the crystals separate from the water, they will reblend when warmed to 90°F and stirred.

Making a Gum Print

1

Mixing the emulsion

Squeeze a ½ in. (1.25 cm) link or worm of watercolor pigment into a paper cup or plate. Add ½ tsp (2.5 ml) of gum arabic, and thoroughly mix the two. Stir in ½ tsp of bichromate solution. Dampen the coating brush in water, then blot it on paper towels.

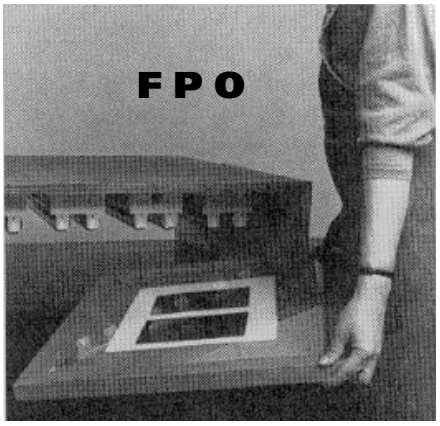


2

Coating the paper

Use the emulsion to coat an 8 × 10 in. (20.25 × 25.5 cm) piece of paper by pouring it from the cup onto the sized paper and quickly working the emulsion on evenly with a brush out to an area beyond the image. The emulsion will not look like the watercolor pigment at this point but will have a yellow-orange tint to it. Lightly smooth the coating with a clean, dry brush.

Use a hair dryer on the cool setting (or the warm setting if you are using the paper shrinking method described on page 121). When the emulsion is dry, make a sandwich with the backing board on the bottom, the paper with the emulsion facing up next, the negative reading correctly on the paper, and clean glass on top.



3

Exposing the print

Place the loaded print frame in the shade for 10 to 30 minutes, under a sunlamp or photoflood bulb 3 ft (1 m) away for 3 to 12 minutes, or under ultraviolet fluorescent bulbs 6 in. (15.25 cm) away for 6 to 15 minutes. Exposure times vary according to the light source, pigment color, and pigment density. You will have to experiment and keep notes.

4

Developing the paper

Because the reaction that occurred during exposure continues after the emulsion has been removed from light, immediately place the paper face down in a tray of warm water. Development, a delicate process, takes from 10 minutes to overnight and consists of floating the paper in warm water that you change often. While the print is developing, you can lighten areas of it by rubbing very gently with a soft brush or cotton swab, but be careful because the emulsion is fragile and severe agitation can remove the image altogether.

5

Fixing the print

When development is complete, the unexposed areas of the emulsion dissolve and the dichromate floats off the paper, leaving the exposed areas the same color as the pigment you used. Transfer the print to a tray of cool water for 15 minutes, then air dry flat or use a cool hair dryer or fan. With the polymer medium method, resize the print before adding a new coating of emulsion. With the alum/spray starch method alone, resize with a new layer of starch.

Tips for Making a Gum Print

■ Before you mix the gum bichromate solution, you can get a sense of how the colors will combine after you print different layers. Take a scrap piece of paper and a brush, mix a dab of each color with water, and layer the liquid colors in the order you were planning to use them. Be sure to let each color dry before you add the next.

■ You must thoroughly mix the pigment with the gum arabic and bichromate solution (see page 125), or the emulsion will be streaked. Improper sizing, such as the gelatin method without a hardener, or too much pigment can cause stains in the developed printing paper.

■ The recipe described in step 1 on page 125 works better for prints with one, two, or three coatings because it yields relatively strong shadows, good middle tones, and clear highlights (although gum prints are pale after just one exposure). An emulsion of a ½ in. link of pigment and ½ tsp gum arabic with 1 tsp bichromate solution shortens the exposure time and is better for halftone negatives, multicolor printing, and printing on fabric.

■ If you are going to use the same negative repeatedly, build up your image by making exposures for highlight, middle tone, and shadow areas. A good working method is to divide your gum-pigment solution into three densities:

> **Light:** 1 in. (25 mm) link of pigment to 1 tsp (5 ml) gum arabic and 1 tsp bichromate solution
>
> **Medium:** 2 in. (51 mm) link of pigment to 1 tsp gum arabic and 1 tsp bichromate solution
>
> **Dark:** 4 in. (102 mm) link of pigment to 1 tsp gum arabic and 1 tsp bichromate solution

Use the lightest solution for the first and longest exposure—this will give you highlights. For the middle tones, lessen the exposure by 1 to 2 minutes and use the medium solution. For the shadows, reduce the exposure again by 1 to 2 minutes and use the dark solution.

■ Because gum bichromate colors are translucent, better tonal separation and color subtlety can be achieved by multiple printings. Also, one printing is usually weak. If you have a set of color separations, apply the yellow layer first with the blue-filtered separation negative. You may have to repeat the yellow because it is such a light color to begin with. Next, print with magenta pigment and the green-separated negative. You may need to coax the magenta off a bit in the deep shadow areas with a soft brush during development so the print does not end up too magenta. Last, use the cyan pigment with the red-separated negative, possibly brushing off any blue that printed in the highlights.

■ A less exact, but easier, method for registering negatives is to use pushpins through the four black borders of the negatives aligned on a light table. As you print, push the pin through the previously made holes in each negative, through the paper, and into a backing board. With this method, you use the same small hole in the paper made by the pushpin and use glass only as large as the edge of the image.

■ The emulsion may be applied to the entire sheet of paper or only to specific areas. To make a smooth coating, use a foam brush and apply in quick, even strokes; for an interesting texture, use uneven strokes and a bristly brush. A foam roller can give either a pointillist effect or a very smooth surface, depending on how much pressure you exert.

■ Do not apply too thick a layer of emulsion, because a heavy coating obstructs the exposure (a thinner coating gives better detail). Rinse and dry your brush as soon as you finish coating the paper.

■ Too much heat from a hair dryer will cause the bichromate to harden and become insoluble in water.

■ Because the emulsion becomes more sensitive to both light and heat as it dries, coated papers do not store well, and the emulsion will harden with time. Coat only as many sheets as you plan to use at one printing session. The three-part emulsion will not store well, either, so mix just enough emulsion to use, coat the sheets immediately, and discard the rest of the emulsion.

■ Avoid working in extremely humid studios because the bichromate solution soaks up moisture from the air and becomes less sensitive.

■ Exposure times for gum printing must be determined by testing, so before you start to work on an actual print, you can reduce future frustration by running the following test:

> Coat with emulsion and dry a sheet of paper. Cut this sheet into 2½ in. (6 cm) strips, marking each strip to indicate the emulsion used. Using a different strip but the same part of the negative, make separate exposures of different lengths of time, being sure to mark the exposure time and light source on the strip. Develop, dry, and evaluate each test for each emulsion used. Keep a notebook with these test strips for future reference. When I use the fluorescent exposure unit described in Chapter 4, I find a 6-minute exposure to be a good starting point with "normal" negatives.

■ Do not worry if you cannot see a latent image on the coated paper after exposure and before development. Sometimes you can see one, but either case is not a sign of a correct or incorrect exposure.

■ If the image was overexposed or the light source was too hot, the emulsion will harden and will not wash off. If the image was underexposed, the emulsion will float off. If you used too thick a coating when applying the emulsion, the image will flake off.

■ Make sure the developing tray is full of water—if the gum print scrapes the bottom of the tray, the image will rub off.

■ You can remove some stains by floating the print in very hot water for 5 to 10 minutes, but be sure to place the print in cold water immediately afterward for the final rinse.

Tips *(cont.)*

■ Gum works beautifully under Liquid Light and over brown or platinum/palladium prints. My personal favorite is gum over cyanotype, but the dichromate in the gum tends to bleach the blue, especially with six or more coatings. Therefore, start with an overexposed blueprint.

■ If a cap on a tube of paint sticks, you can loosen it by holding a lighted match under the cap for a few seconds. Clean the threads with a tissue, then apply a little petroleum jelly to the threads to avoid this problem in the future. If the paint has dried up, just remove a hunk of it by cutting the bottom of the tube, then soak the dried chunk in a little distilled water until it softens.

■ Pebeo's Setacolor fabric paints (which are less fugitive than dyes) come in 34 light-sensitive colors that are applied to either natural or synthetic fabric and used wet. You place objects (e.g., leaves, shells, cheesecloth) directly on top of the light-sensitive paints after they have been diluted with water and coated on cloth, and put the setup in the sun or under heat lamps. When the fabric dries, you have a print without any further processing. Once the fabric is heat cured, it is wash-fast and color-fast and can be dry cleaned. Made in France, the dyes and instructions for their use are available in the United States at a 40% discount from Fabrics To Dye For (see Supply Sources).

Chapter 9 CASEIN PIGMENT PRINTS

Casein printing, which utilizes curdled milk to bind the component materials, was patented in 1908 as a technique to use with other photo-printmaking methods, such as Van Dyke brown printing (see Chapter 7). Used by itself, however, casein printing can yield results that are as subtly graded and colorful as the watercolor paints that make up part of the emulsion. The translucency of each color coating permits a new hue in a new layer of emulsion to change the pigment color underneath. One of the least expensive of the hand-applied emulsion methods, casein printing is closely related to gum bichromate printing (see Chapter 8), and a reading of that chapter is recommended.

Safety

Bichromate (also called *dichromate*) can cause skin inflammation, similar to an allergic reaction, upon repeated exposure. Wear protective gloves and goggles at all times when mixing and coating bichromate as well as when washing a bichromate-sensitized print. Wear a respirator with a toxic dust filter when handling bichromate crystals.

Bichromates can be poisonous when ingested, even in small quantities. Keep chemicals and chemically contaminated materials away from your mouth and out of the reach of children and pets. Bichromates are suspected carcinogens.

Dispose of excess solution or chemical by flushing it down the drain with a large volume of water, not in a wastepaper basket.

Certain paint pigments, such as emerald green, cobalt violet, true Naples yellow, all cadmium pigments, flake white, chrome yellow, manganese blue and violet, Verona brown or burnt umber, raw umber, Mars brown, lamp black, and vermillion, can lead to poisoning and other complications if they are ingested or inhaled frequently. Wearing a respirator, working in a ventilated area, and carefully washing your hands and cleaning your fingernails after using these pigments can prevent accidentally carrying them to the mouth and ingesting them.

Method Overview

1 Paper or fabric is sized, preshrunk, and dried.

2 Under subdued light, the paper or fabric is coated with casein pigment emulsion and allowed to dry.

3 The coated surface is placed in contact with a negative or object, and ultraviolet light is shone through the negative.

Method Overview *(cont.)*

4 The negative is removed. The paper or fabric is developed in water, where unexposed areas of color are dissolved, leaving a reversed image to dry and harden.

5 One coating must dry before a new layer may be applied, exposed, and processed.

Materials

Thoroughly read the previous chapter on gum bichromate printing, since these two techniques have similar requirements.

1 Image. Negatives of low density (not heavy black) the same size as the print you wish offer the possibility of full tonal range after one exposure to casein pigment emulsion. More often, though, the density of the negative exceeds the range of the emulsion, requiring multiple exposures to build up highlights, middle tones, and shadows. Posterized negatives (described on page 79) or color separation negatives (described on pages 79 and 120) offer versatility. High-contrast negatives also work quite well. If more than one printing is desired, negatives will need to be registered, as described later in this chapter.

Try stencils, found objects, torn paper, lace, drawings, and photocopies on acetate.

2 Chemicals. You will need either potassium or ammonium bichromate or dichromate, which can be purchased in 1 lb (0.5 kg) or smaller bottles from the suppliers listed in the back of this book. Ammonium bichromate is preferred for its greater sensitivity to ultraviolet light.

Instant powdered milk, available in grocery stores, provides the casein binder. Undiluted lemon juice or 28% acetic acid, sold as stop bath in photo stores, curdles the milk. A bath of clear ammonia (nonsudsy) from a grocery store or ammonium hydroxide diluted with water to a 1% strength helps clear a muddy print and also is one of the elements in the emulsion.

3 Pigments. Professional-grade watercolors or gouache in tubes work best. Liquid casein colors have been used with some success. Make sure that the pigment you use has no chromium (such as chrome yellow) in it, because this will react negatively with the bichromate.

4 Distilled water. Sometimes tap water is fine for making the bichromate solution, but the use of distilled water eliminates the frustration of possibly mixing bad solution.

5 Receiver. Finished prints should be produced on rag paper of medium absorbency for longevity, but practice prints can be made on less-expensive paper. All paper should be sized (see page 57), then preshrunk, for more than one coating. James R. Collins, author of "The Gum Print" in *Darkroom Photography* (October 1986), suggests the following method:

> Size the paper, then air dry it. Apply the emulsion to an area about 1 in. (2.5 cm) larger on all sides than the image, and hang the paper in front of a cold-air fan to dry. When the emulsion is just barely tacky to the touch, put two pencil dots 12 in. (30.5 cm) apart and about ⅛ in. (5 mm) inside the emulsion edge. Hold a hair dryer about a foot (30.5 cm) from the paper, and evenly blow warm air over the paper until it has shrunk the paper by

1/8 in. (5 mm) and the pencil dots measure 11 7/8 in. (30.25 cm) apart. Make the exposure, develop the image, and repeat this preshrinking (without resizing) procedure with each coating.

Preshrink synthetic or natural fabrics as described above. Practice making prints on paper first, because working on fabric is more difficult.

6 Sizing. Because sizing paper and fabric is necessary, messy, and time-consuming, you will find it more practical to size several pieces at once. The acrylic polymer medium method (see page 58) works well. It is easy, but it stiffens the paper and will not allow for the shrinkage described in item 5 above. Todd Walker's alum sizing method is more appropriate. See Chapter 4 for size formulas.

7 Ultraviolet light. You cannot see a color change with the emulsion, as you can in cyanotype or Van Dyke brown printing, so artificial lights such as sunlamps, photofloods, or fluorescents are recommended because the exposure can be exactly timed. However, indirect sunlight can be used; avoid direct sunlight because bright radiant heat output can cause the emulsion to fog with exposures over 5 minutes.

8 Applicators. Try fine flat bristle brushes or nylon paintbrushes about 1 in. (2.5 cm) or more wide, a sponge brush, or a foam paint roller from the hardware store. A small soft brush for coaxing the development of the print in water can be handy. Keep the metal part of the brush out of the bichromate solution. If you use an atomizer or air brush, be sure to wear a respirator and work in a well-ventilated area.

9 Brown bottle. Because one of the emulsion's components, diluted ammonium or potassium dichromate, is light sensitive, it should be stored in a dark bottle, such as a clean, used fruit juice jar.

10 Cheesecloth and mesh food strainer. Inexpensive cheesecloth, purchased at a hardware or grocery store, is used to line a food strainer when cleaning the casein base.

11 Printing frame. Use glass with Masonite, another sheet of glass, or foam core backing, or follow the instructions on pages 43–45 for building a frame.

12 Two trays or tubs. You will need glass or porcelain trays larger than the print when you develop the image and fix it.

13 Timer, watch, or clock.

14 Measuring spoons. Cooking utensils are fine. Small, clear (102 ml) medicine measuring cups, available at pharmacies, are useful.

15 Measuring cup or beaker and stirring rod. You will need a cup or beaker that measures 16 oz (455 cc) in 1/2 oz (14 cc) increments.

16 Two registration pins, masking sheets, masking tape, 1/2 in. (1.25 cm) wide heavy black tape, ruler, hole punch, scissors, stencil knife *(optional).* If you are using more than one negative or more than one color, and you want the layers of the image to line up repeatedly, follow the instructions for registration found in Chapter 4.

Materials *(cont.)*

17 Spray nozzle for sink hose, kitchen blender (*optional*). These two items make the job of mixing the casein and the dichromate easier. Do not use the blender for preparing food afterward.

18 Protective gloves and respirator.

19 Shallow bowl. A small glass or china bowl or plate becomes the palette for mixing the emulsion.

20 Newspaper, hair dryer.

Tip for Making the Bichromate Solution

■ Should the crystals separate from the water, they will reblend when warmed to 90°F and stirred.

Tips for Making a Casein Print

■ You must thoroughly mix the pigment with the casein and bichromate solution, or the emulsion will be streaked.

■ Because the casein curd will dissolve 3 hours after adding the other chemicals to it, plan on doing multiple coatings during one print session.

■ The pure casein can be refrigerated and preserved for a few days.

■ Exposure times for casein printing must be determined by testing, so before you start on an actual print you can lower the frustration level by running the following test:

> Coat with emulsion and dry a sheet of 8 × 10 in. (20.25 × 25 cm) paper. Cut this sheet into 4 × 5 in. (10 × 12.5 cm) strips, marking each strip to indicate the emulsion color and formula used. Using a different strip for each exposure, make tests of different lengths of time, being sure to note the exposure time and light source on the strip. Make sure the same part of the negative is used for each test. Develop, dry, and evaluate each test for each emulsion used, and keep a notebook with these test strips for future reference.

■ If the image is overexposed or the light source is too hot, the emulsion will harden and will not wash off. If the image is underexposed, the emulsion will float off, and if you use too much pigment when mixing the emulsion, the color will flake off.

■ While the print is developing, you can lighten areas of it by rubbing very gently with a soft brush or cotton swab, but be careful because the emulsion is fragile and severe agitation can remove the image altogether.

■ In the January/February 2000 issue of *Photo Techniques,* Bob Whitfield describes "a new process: gelatin acrylic." He uses posterized high-contrast positives with semi-gloss house paint on paper sized with gelatin and coated with bichromate.

Making the Bichromate Solution

Equipment You Will Need

Ammonium bichromate crystals

Measuring cup or beaker

Bowl or tub

Stirring rod

1 oz (30 ml) measuring cup

Distilled water

Label

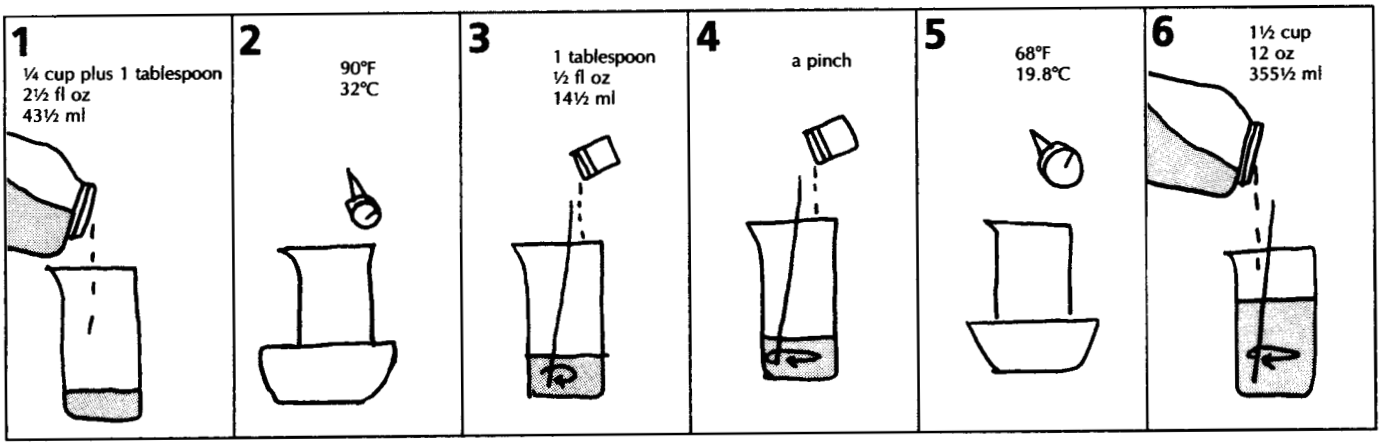
Brown bottle

Thermometer

Neoprene gloves

Respirator with toxic dust filter

Procedure



1. Pour water into measuring cup to make ¼ cup plus 1 tablespoon (43.5 ml, 2½ fl oz).

2. Adjust water temperature to 90°F (32°C).

3. With constant stirring, add 1 tablespoon (14.5 ml, ½ fl oz) bichromate crystals.

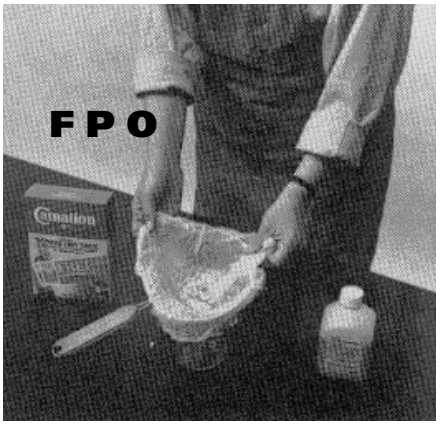
4. Add more bichromate until crystals will not mix in, but precipitate to the bottom of the liquid.

5. Adjust water temperature to 68°F (20°C).

6. Stirring constantly, add water to make 1½ cups (355.5 ml, 12 oz) of solution.

7. Pour the bichromate solution into a labeled brown bottle.

Making a Casein Print



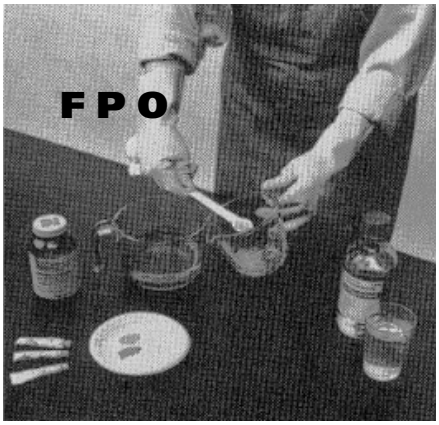
1

Curdling the milk

In a measuring cup, mix 1 oz (30 ml) instant powdered milk with 7 oz (199 cc) hot water. By adding a few drops of 28% acetic acid or lemon juice to this mixture, curdle the milk.

Arrange two layers of cheesecloth in a strainer, pour the curdled milk through it, catching the curd in the cheesecloth, and rinse the curd with cold water.

Squeeze the cheesecloth and curd.

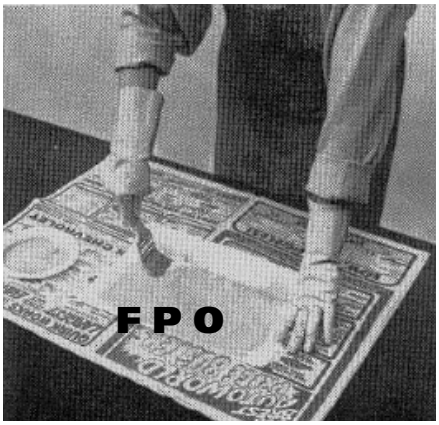


2

Mixing the emulsion

Crumble the curd into a measuring cup, add 2 oz (50 cc) of 1% ammonia, and mix well by hand or electric blender.

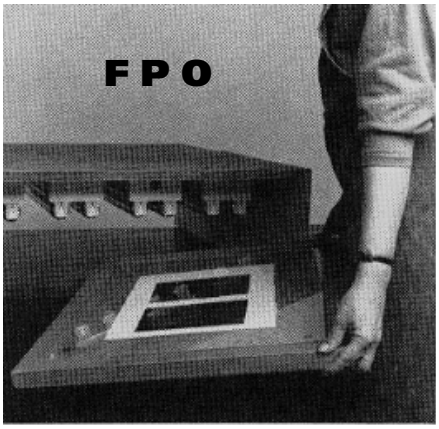
Thoroughly mix 1/2 tsp (2.5 ml) of the casein (or curd) mixture with 1/2 tsp of the dichromate solution and 1/4 tsp (1.25 ml) watercolor pigment.



3

Coating the paper

Use the emulsion to coat one 8 × 10 in. (20.25 × 25.5 cm) piece of paper by pouring it from the cup onto the sized paper and quickly working the emulsion on evenly with a brush to an area beyond the image. The emulsion will not look like the watercolor pigment at this point, but may have a yellow-orange tint to it.

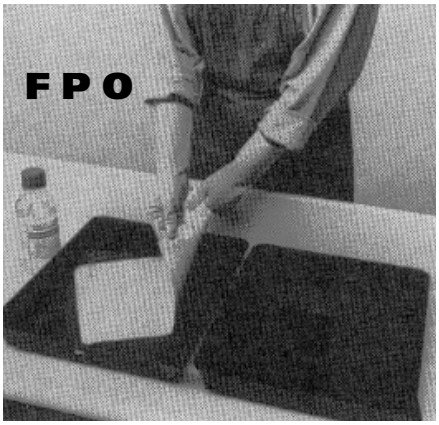


4

Exposing the print

Use a hair dryer on the cool or warm setting (based on the paper shrinking method, page 130), and when the emulsion is dry, make a sandwich with the backing board on bottom, the paper with emulsion facing up next, the negative reading correctly on the paper, and clean glass on top.

Place the loaded print frame in shade for 10 to 30 minutes, under a sunlamp or photoflood bulb 3 ft (1 m) away for 3 to 12 minutes, or under ultraviolet fluorescent bulbs 6 in. (15.25 cm) away for 6 to 15 minutes. Exposure times vary according to the light source, pigment color, and pigment density. You will have to experiment and keep notes.



5

Developing the paper

The reaction that occurred during exposure continues after the emulsion has been removed from light. Therefore, immediately place the paper face down in a tray of cool water for 5 minutes. Move the print to a tray of 2 oz (57 ml) of 1% ammonia and 32 oz (909 ml) cool water for 5 minutes. Development may take several dips back and forth; it is complete when the unexposed areas (highlights) of the emulsion dissolve and float off the paper and the exposed areas (shadows, middle tones, and highlights with detail) are the same color as the pigment you used.

6

Fixing the print

Transfer the print to a final tray of gently running cool water for 15 minutes, but be careful that the stream of water does not hit the emulsion. Remove the print, and air dry it flat or use a hair dryer. Resize the print if you want to add another layer of emulsion.

Chapter 10 PLATINUM AND PALLADIUM PRINTS

Historically considered the premier, treasured, hand-coated emulsions among photographers, platinum and the closely related palladium are two of the tonally richest and most permanent emulsions available. Depending on the paper and processing procedures used, the more expensive platinum can yield cool velvety blacks, while palladium renders warmer blacks and sepia browns. Although both processes are probably the most costly covered in this book, they can be combined with each other as well as with gum bichromate (Chapter 8), cyanotype (Chapter 6), and other techniques.

Sir John Herschel was the creative British scientist who originated the formula for cyanotypes and figured out fixer for black-and-white photography and for Van Dyke brown prints. He announced publicly that platinum, when mixed with other chemicals, becomes sensitive to light. Forty years later, in 1873, William Willis refined, patented, and eventually manufactured kits for the platinum printing process that included precoated paper and the requisite chemicals. He called his venture the Platinotype Company, but he later manufactured less expensive palladium kits as well. Other manufacturers, such as Ilford, (Agfa) Geveart, Ansco, and Kodak eventually entered the market.

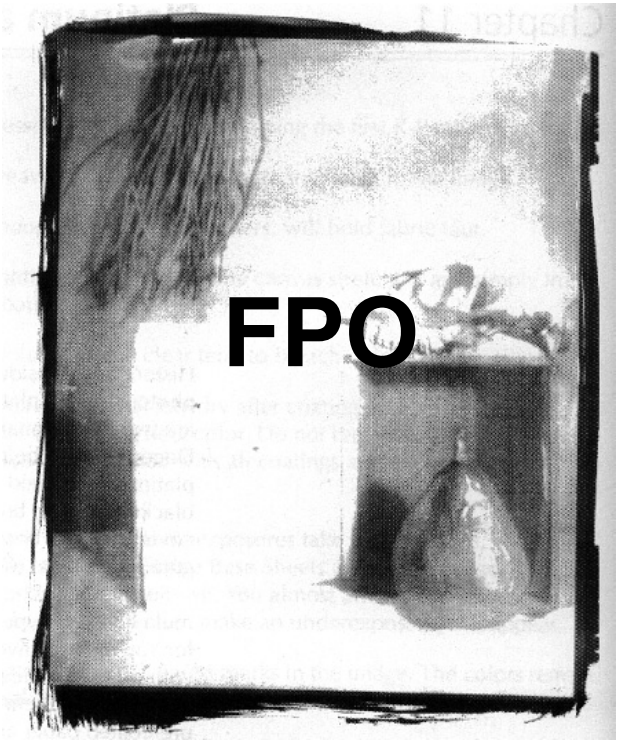
Because of the emulsions' stability and permanence, relative ease to procure and use, and their sensuous results, at the turn of the century platinum and palladium were used by diverse and influential artists such as Frederick Evans, Alfred Steiglitz, Paul Strand, Edward Steichen, Gertrude Käsebier, and Francis Benjamin Johnston. When the cost of these metals increased (partly because of the discovery that platinum could be used to make explosives), platinum became so expensive that most manufacturers eventually stopped making coated papers. Still, Laura Gilpin and Imogen Cunningham, among a group of platinum and palladium aficionados, coated their own papers and continued the tradition for decades. More recently, Irving Penn, Robert Mapplethorpe, and W. Snyder MacNeil (see Plate V) have been part of the resurgence of platinum and palladium printers who have shown their work at prestigious galleries and used the processes in the commercial world. The Palladio Co. (see Supply Sources) has started making machine-coated papers again.

Safety

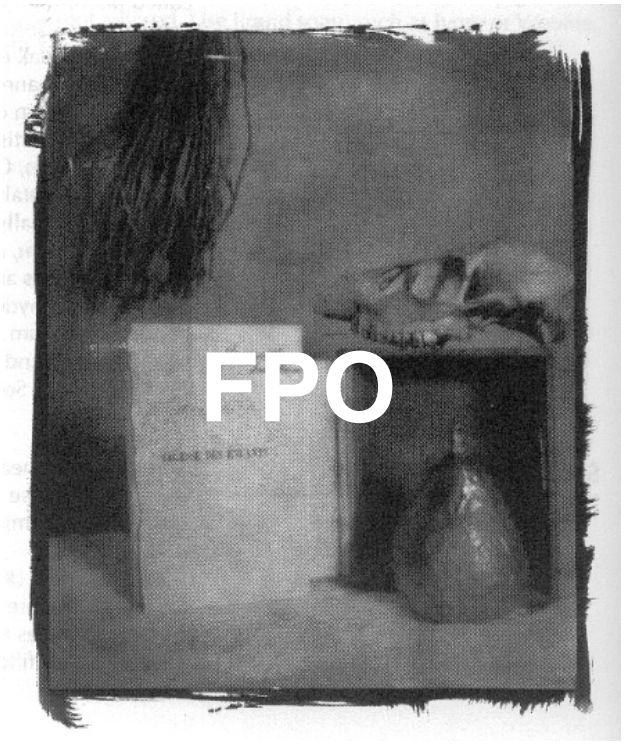
Because of the health hazards and the number of chemicals used to make the solutions, I advise the use of premixed sensitizers as described later in this chapter. All chemicals should be clearly labeled and kept out of reach of children and pets.

Ferric oxalate (No. 1 and No. 2 solutions) is corrosive to the skin, eyes, nose, and throat and causes severe internal damage—even death—if swallowed. Wear protective gloves and goggles. When mixing from the powder,

Jesseca Ferguson printed these three palladium images using one of her 8 × 10 in. pinhole negatives (Kodak Tri-X developed in Ektaflo diluted 1:15 for 2½ minutes). She used Bostick & Sullivan's premixed palladium chemistry, Crane's PS811 stationery, and an ultraviolet exposure unit (built according to the plans provided in this book). The mixtures and exposure times are listed with each image.

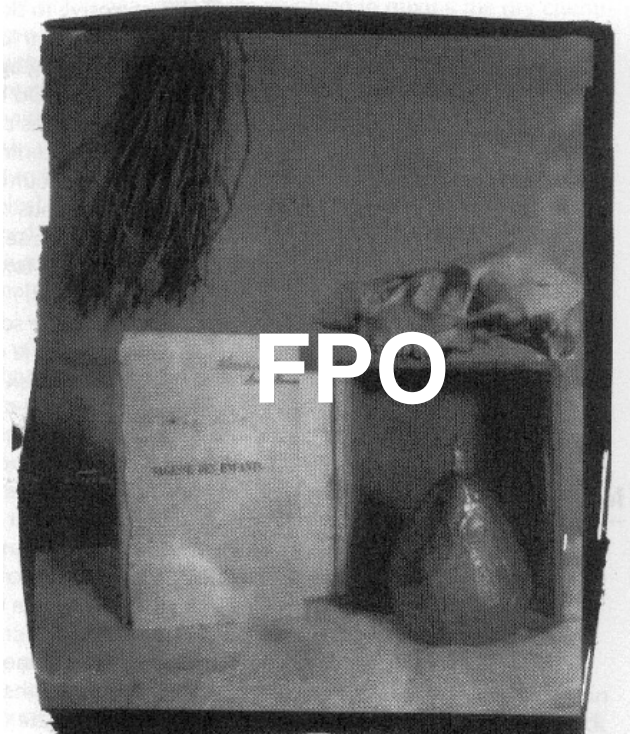


Version I
Solution No. 1, 9 drops; No. 2, 13 drops; No. 3, 24 drops; 5-minute exposure.



Version II

Solution No. 1, 18 drops; No. 2, 4 drops; No. 3, 24 drops; 10-minute exposure.



Version III

Solution No. 1, 14 drops; No. 2, 8 drops; No. 3, 24 drops; 12-minute exposure.

Safety *(cont.)*

use a respirator with toxic dust filter or a good triple-layer paper mask at the least. If it should spill on your skin, wash immediately with soap or pHisoderm™ and water. Keep the top of the dropper bottles and the screw thread free of dried ferric oxalate by wiping them frequently with a damp paper towel.

Potassium chlorate (No. 2 solution) is added to increase contrast. Because it is moderately toxic on skin contact, protective gloves should be used. If you are using the powder form to mix your own sensitizer, be aware that it is highly flammable and explosive. If it spills or is contaminated with impurities such as flammable or organic materials, it should be removed immediately with water. Care should be taken to avoid dropping, friction, and heat. Potassium chlorate should be stored away from heat and combustible materials, and a fume hood or acid gas respirator should be used to avoid the fumes, which are toxic.

When mixing from scratch, oxalic acid is sometimes used to make the emulsion more light-sensitive. It is extremely toxic on skin contact, ingestion (it can be fatal if swallowed), and inhalation. Wear protective gloves, goggles, and an acid mask. In case of eye contact, flush with water for 15 minutes and seek medical attention. If swallowed, call your local poison center. Do not induce vomiting.

Palladium chloride (No. 3 palladium solution) is slightly toxic on skin contact and inhalation, so handle it with care and use a skin barrier cream. *Overexposure: Health Hazards in Photography* reports that palladium chloride causes cancer and reproductive changes in laboratory animals.

Platinum chloride (No. 3 platinum solution) is moderately toxic on skin contact and may cause allergic reactions. It is much more dangerous to breathe and can cause problems such as nasal irritation, asthma, or lung scarring and emphysema from repeated inhalation. Wear protective gloves and goggles when using platinum chloride and a respirator with a toxic dust filter when mixing from powder.

Potassium oxalate is used in some formulas for developer. Because it prevents blood from clotting, it is highly toxic on inhalation and ingestion. It is also corrosive to the skin, eyes, nose, and throat, and can cause internal damage or death. I urge you to use ammonium citrate developer instead.

EDTA clearing agent is slightly toxic, so handle it with care and use a barrier cream. Do not inhale the powder.

Some formulas call for hydrochloric acid in the clearing bath or in the developer. The concentrated form is highly toxic on skin contact, inhalation, and ingestion. It should never be used near ammonia products, and the gas from the acid is dangerous. Potassium dichromate, which can be added to hydrochloric acid to increase sensitivity, is moderately toxic on skin contact and ingestion, but highly toxic on inhalation. For these reasons, I recommend the use of EDTA instead.

Gold chloride solution can be added to palladium sensitizer, a few drops at a time, to warm the color or even turn it pink. It is moderately toxic, but wear gloves and a mask when repeatedly handling the powder because it can cause respiratory, kidney, and nervous system disorders.

Richard Sullivan states in *The New Platinum Print* that platinum and palladium are a potential environmental hazard when you dispose of used developer. He asserts that these metals "may be removed by adding a small quantity of steel wool to the developer: about 1 pad per gallon of solution. Metallic iron will reduce out any noble metals into their pure state. After sitting overnight, there might be a small residue of platinum or palladium metal in the bottom.

Pour off the developer and save the black metal in the bottom. The steel wool may also be shiny, which means it's been plated by the noble metals in the developer." Then dispose of it according to local regulations.

Method Overview

1 The emulsion is prepared by mixing together drops of sensitizer customized to work with your transparency.

2 Paper or fabric is sized and coated with the platinum or palladium salts sensitizer. It contains ferric oxalate, an iron salt.

3 An enlarged negative or object is placed on top of the coated surface. Light shines through the clearer parts of the negative or around the object, reducing the ferric oxalate to the ferrous state.

4 The exposed paper or fabric is developed. The ferrous oxalate dissolves and further reduces the platinum or palladium salts to dark pure metal in the exposed areas and a slight neutral tone in the highlights.

5 The paper or fabric is washed, then placed in successive clearing baths to eliminate background tinge. It is washed again and dried.

Materials

More detailed descriptions of materials are given in Chapter 4, Creating the Photo-Printmaking Studio.

1 Image. You will need a negative transparency the same size as the positive print you wish to create. Both palladium and platinum emulsions render a seemingly limitless array of tones; thus, whatever is on the negative should appear in the print. In addition, the emulsions can be mixed to suit your negative and your desired result. There is great latitude in the appearance of the transparency.

Many printers prefer dense negatives with a lot of separation in the shadow and midtone detail. Try overexposure and underdevelopment when making the positive before you contact it to another sheet of film to make a negative (see Chapter 5, Making Negatives). Once you make that positive you can make a more contrasty negative for platinum or palladium printing by using less-dilute (e.g., Dektol 1:3) developer, and can make a low-contrast negative (Dektol 1:9) for gum printing if you are planning on combining processes. Or, try Agfa N31 P film and HC-110 developer diluted 1:3, preferably in a drum or tube processor.

If you use a view camera, try loading it with Kodak Tri-X or Ilford HP5 and overdeveloping by 15% to 30% in HC-110 (dilution B) or with Pyro Developer. These methods are not explained in detail in this book, so look in the bibliography for one of the platinum printing books that does go into detail.

2 Chemicals. If I can acquire what I need already mixed without sacrificing quality, I do so because of the health hazards involved in mixing dry chemicals. I recommend you purchase either the Standard Platinum or the Standard Palladium Kit premixed from Bostick & Sullivan (B&S) or from Photographer's Formulary (see Supply Sources), who send a catalog and instructions. The kit

Materials *(cont.)*

contains enough sensitizer to make sixty 4 × 5 in. (10 × 12.5 cm) prints. When you need to replenish, you can order specific premixed chemicals separately. Bostick & Sullivan also ship the Euro Kit for either technique because "it was not economical to airmail [U.S.] water to Finland—the Finns have their own." This kit contains premeasured, mostly dry chemicals to make sixty 4 × 5 in. prints. The Formulary will send dry chemicals, too. All B&S kits contain ammonium citrate developer for cool tones and a bit higher contrast and EDTA clearing agent. Both B&S and the Formulary sell potassium oxalate developer, which renders warm tones, and sodium citrate developer for warmer tones and higher contrast. The palladium kit is approximately one-half the price of the platinum kit. Because pure platinum is trickier to print and produces higher contrast, many printers combine palladium with some platinum sensitizer.

You can mix 1 Tbsp sodium sulfite with 10 g oxalic acid and 1 liter water for a clearing bath, or use Kodak Hypoclear diluted as the manufacturer recommends. The quickest clearing, however, is accomplished in a bath of 1 Tbsp sodium sulfite, 1 Tbsp EDTA, and 1 liter water.

Bostick & Sullivan sells a related process, Ziatype, that does not require a developer; the color is controlled in the sensitizer. In addition, this "printing out" process allows you to watch the image form during the exposure, so that you can stop it when the print looks right.

3 Distilled water. If you are starting with dry chemicals, distilled water prevents mixing a bad batch of emulsion due to impurities in tap water. I also use distilled water to mix the clearing baths, and many printers use it for the required washes. Dipping your coating brush in clean distilled water and blotting out the excess before spreading the emulsion helps to prevent the brush from taking up too much emulsion.

4 Receiver. If you are printing on paper—and I recommend that you do before you experiment with other surfaces—you will notice that the paper type dramatically affects the resultant image. Rag paper is more archival and works best with these permanent emulsions. Rag papers tend to hold up when submerged in liquids for processing. Crane's Kid Finish, a good sheet to practice on, can be bought at stationery stores. It comes in cream (ecru) or white and in standard 8½ × 11 in. (21.5 × 28 cm) sheets of 25, 100, or 500 to a box. Bostick & Sullivan carries Crane's Kid Finish in larger sheet sizes, Crane's Platinotype (specifically sized for platinum), and Parchmont. Crane's manufactures with enough sizing that you will not have to prepare their paper, but you must handle it carefully in the clearing baths so that it will not rip. A method that seems to work well is to use nylon screening larger than the sheet of paper underneath the paper before you insert it in the first tray of liquid. With gloved hands you then can easily pick up the screening with the paper on top to move it from tray to tray. This method can be used with other delicate receivers, such as rice paper, calligraphy paper, and vellum. One of the advantages of these surfaces is that you can easily coat the emulsion, dry it, and recoat and dry it (see this chapter's Tips) to ensure more detail in the final print. Vellum needs to be preshrunk, as explained in Chapter 4, because it tends to stretch when you coat it and will not lay flat under the negative.

I like perusing art stores for smooth (because I prize detail) but absorbent rag papers, which tend to yield more sensuous tones than the Crane's paper mentioned previously. Arches 88, Opaline Parchment, Arches and Fabriano 90 lb

hot press, Strathmore 400 drawing (for palladium only) or 500 Series Bristol, Rives Lightweight (for practice prints, because it is less expensive) and Heavyweight, Rives BFK, and Bienfang Rag Layout come highly recommended. All of these papers must be sized, as explained in item 6 below.

Arches has begun manufacturing Platine Paper, a 100% cotton, smooth, white, heavy (310 g) paper that needs no extra sizing. In the United States, it is available at Pearl Paint, or you can call Canson Talens at 800-628-9283 for product information and local distributors. Martin Axon, printer of Robert Mapplethorpe's platinum prints and owner of Platinum Press (see Supply Sources) tested paper for Arches and also sells Platine in 30 × 44 in. (76.5 × 112 cm) and 22 × 30 in. (56 × 76.5 cm) sheets. In Europe, your art store can call Arches directly. This paper is fantastic if you are going to combine platinum and palladium together or with other processes because it holds up under repeated immersion in liquid and needs no special preparation. It is such a bright white that the image looks higher contrast, so I use the double coat method described in the Tips for more depth in the tones.

Fabrics need to be natural. (See page 99 of Chapter 6, Cyanotypes, for more details.) The original Platinotype Co. sold sensitized linen, sateen, and cotton, Luis Nadeau writes. Using painters' canvas stretchers conserves chemistry and facilitates working on fabric.

In the original patent Willis claimed that he applied platinum emulsion by either one or more coatings to "paper, *wood* and other suitable materials" (italics mine). The wood need not be sized, but rather prepared as described in Chapter 6 (p. 99).

5 Ultraviolet light. Sunlight can be used, but because of variances in the strength of ultraviolet light according to the time of day and season, dependable results can be difficult to obtain. Artificial exposure sources, as described in Chapter 4, Creating the Photo-Printmaking Studio, are more consistent or use a sunlamp centered above and covering the emulsion. Do not look at exposure lights without ultraviolet-protective goggles.

6 Sizing. Rag papers usually are made with sizing, but if you use less expensive paper, rice paper, or absorbent paper such as Rives BFK, you may want to size both for technical reasons (to prevent the paper from absorbing too much emulsion, thereby making even coating, reasonable exposures, and complete clearing difficult) and aesthetic reasons (different sizings affect the color of the emulsion differently). I recommend the arrowroot or starch methods for warmer results and the gelatin size for cooler hues. See pages 57–58 for more details. Arrowroot sizing is not effective for multiple printing, however, such as gum over platinum or palladium.

7 Applicators. Polyfoam brushes 1 in. (2.5 cm) wide or more work well, but tend to deteriorate after several uses. Care needs to be exercised when coating the emulsion on rag paper because too much pressure will abrade the paper. A modern imitation of the old-fashioned Blanchard brush is described on page 59. My favorite applicator for showing the brush stroke in the finished print is the sturdy Hake brush, available at good art stores. Its bristles are sewn to a wooden handle and need to be cut to approximately ½ in. (1.25 cm) so that they do not soak up too much emulsion. Camel hair brushes with trimmed bristles are fine too. Platinum Press and Bostick & Sullivan sell a tube to lay down a smooth coating while saving chemistry. You can even use an atomizer to spray emulsion on the receiver if you lightly wipe the emulsion down with velvet afterward. Whatever applicator you use, make sure that the emulsion

Materials *(cont.)*

does not come in contact with metal and that the applicator is not used for any other process.

You probably will want paper towels to wipe the applicator and bottle (see Safety) as you work.

8 Printing frame. To ensure strict contact between the negative or flat object and the emulsion and to avoid a blurry image, use plate glass with Masonite or another piece of glass. See Chapter 6, Cyanotypes, for more details. Or follow the instructions on pages 43–45 for building a frame. The frame needs to accommodate the dimensions of the paper, wood, or fabric.

9 Small brown glass bottles with medicine droppers. You will need to purchase and label three bottles and three droppers if you are mixing from scratch. For platinum/palladium prints, you will need four bottles and droppers. If you are using premixed solutions from Bostick & Sullivan or Photographer's Formulary, who ship sensitizers in clearly marked brown glass bottles, you will need only the droppers, available from a drugstore. The emulsion contrast is controlled by counting drops of each of the two ferric oxalate components. Do not use the same dropper for the different sensitizers.

If you are mixing from powders, you will also need a plastic or glass 1 qt (0.95 L) container for developer. Bostick & Sullivan ships their ammonium citrate developer as a liquid in a plastic bottle; the Formulary sends you dry potassium oxalate for developer, and you add water to it.

You can save leftover clearing baths in three properly labeled 1 qt (0.95 L) plastic or glass milk bottles.

10 Five trays or tubs. The trays must be nonmetallic and larger than the print—three hold the clearing baths and one is for the final wash water. If you use the sodium sulfite and EDTA recipe mentioned in item 2, you will probably need only one clearing tray; if you use Hypoclear you will probably need only two trays. In addition, I use a Pyrex baking dish as both the developing tray and a first water wash tray because it is easy to clean. You can also use a plastic photo tray, but do not use it for any other processes.

11 Siphon washer and safelight. The siphon, available at photography stores, works well to wash prints when attached to a tray in a sink. Or you can drill small holes in the sides of a dish tub or photo tray and gently run water directly from a faucet over the back of the print. Both methods allow clean water to enter while contaminated water drains off. You can blot the print afterward with a clean, soft sponge or air dry it on a rack. A rack protected from light also is useful for allowing the emulsion to sink in after it is coated, as explained in the step-by-step instructions.

The emulsion needs to be coated and dried away from ultraviolet light, which is found in the exposure unit and in normal fluorescent room lights. Work only under safelights, tungsten light, or a 60-watt yellow bug light available at a hardware store.

12 Sheet of glass or Plexiglas *(optional)*. Hold the developed print at an angle on a sheet of glass while doing a preliminary wash. This system allows unused chemicals to drain off, preventing them from contaminating the print. Wrap masking or duct tape around the edges to prevent the glass from cutting you and to cushion it from breaking. Follow with a tray wash.

You may want to tape your substrate onto another sheet of Plexiglas or a coating board while you apply the emulsion.

13 White bowl or saucer. I use white ceramic (never metal) for mixing the sensitizer drops because they are easier to see on white surfaces under subdued light. Some printers use a shot (jigger) glass or egg cup.

14 Beakers or measuring cups (32 oz or 1 L), tablespoon. You will need a container of distilled water for holding and rinsing out the coating brush, but make sure you remove excess water from the bristles before coating each print. A large beaker of hot water or a hot plate comes in handy for heating up the developer beaker to 120°F (49°C) for warmer tones in a palladium print and for warming the bottle of No. 3 platinum sensitizer, which has a tendency to precipitate out of solution. Glass beakers conduct heat more rapidly than plastic. If you are mixing your own solutions, you will need measuring utensils and a gram scale. Again, do not use metal. See item 21.

A tablespoon is used for measuring the EDTA powder for the clearing baths.

15 Funnel, tongs. Use a glass or plastic funnel to save prepared liquids or when mixing stock solutions from dry chemicals. Use tongs or wear heavy gloves to move prints in the clearing baths.

16 Newspaper or cardboard. Cover the coating area with newspaper or coat on corrugated cardboard into which you pushpin the paper.

17 Humidifier *(optional)* and heater. Jesseca Ferguson, who created the illustrations at the beginning of this chapter, always keeps her studio at 50% to 60% relative humidity, which she checks with a wall-mounted digital meter. Especially in cold weather when the air can dry out, adding humidity can help with the coating procedure. You may need to run the humidifier for an hour for Ziatype. Platinum, palladium, and Ziatype are sensitive to cold, which can cause graining. Heat up the room to 75°F (24°C).

18 Protective gloves, mask, and apron. Wear heavy neoprene gloves while you work, a respirator for mixing powders, and an apron to protect your clothes from contamination.

19 Hair dryer and/or clothesline and pins. Use a hair dryer on the cool setting or a fan to thoroughly dry the emulsion before laying a negative on top. A clothesline and pins or a rack can be used to dry finished prints. Please note that in item 11, a drying rack protected from light is recommended.

20 Pencil, tape. It may be easier to tape or tack the receiver to a table or board and draw an outline of your negative on it to facilitate coating the emulsion. Make a cardboard template, or use the cardboard package with the film so that you do not accidentally damage the negative.

21 Typing paper and gram scale *(optional)*. If you are weighing raw chemicals, they should not come in contact with metal or other contaminants. Avoid this problem by placing a sheet of lightweight paper on your scale. Shake solutions in their individual bottles to mix them.

Mixing the Stock Sensitizers

This recipe is included if you really must mix from scratch, but I truly advise that you skip this procedure and order the three premixed sensitizers from Bostick & Sullivan or Photographer's Formulary for the sake of your health and safety. Use a gram scale and be exact.

Sensitizer No. 1 (low contrast)

Mix together:

- 1½ oz (50 cc) distilled water at 100°F (38°C)
- 1 g oxalic acid (optional)
- 13 g ferric oxalate

Use at room temperature.

Sensitizer No. 2 (high contrast)

Mix together:

- 1½ oz (50 cc) distilled water at 100°F (38°C)
- 1 g oxalic acid (optional)
- 13 g ferric oxalate
- 0.6 g potassium chlorate for platinum

or

- 0.3 g potassium chlorate for palladium

Use at room temperature.

Sensitizer No. 3 (metal)

For platinum, mix together:

- 2 oz (80 cc) distilled water at 100°F (38°C)
- 20 g potassium chlorplatinite: crush it with a plastic spoon, then pour it into the water slowly while stirring.

For palladium, mix together:

- 2 oz (80 cc) distilled water at 100°F (38°C)
- 8 g palladium chloride: crush it with a plastic spoon, then pour it into the water slowly while stirring.
- 6 g sodium chloride

Sensitizer No. 4 (optional)

- 1–2% gold chloride, a few drops to warm the tones and reduce the contrast of a platinum print or to tint a palladium print toward lavender. If you want only to change the tones and not reduce the contrast, add more drops of high-contrast (No. 2) and less low-contrast (No. 1) sensitizer. If gold chloride is used, do not replenish the developer as suggested in the tips.

Developer

Mix together:

- 1 lb (453.5 g) potassium oxalate
- 48 oz (1.5 L) distilled water at 120°F (49°C)

The shelf life of solutions No. 1 and No. 2 is approximately 3 to 6 months in a tightly stoppered brown bottle. The metal sensitizers and oxalate developer will last indefinitely in a tightly stoppered brown bottle.

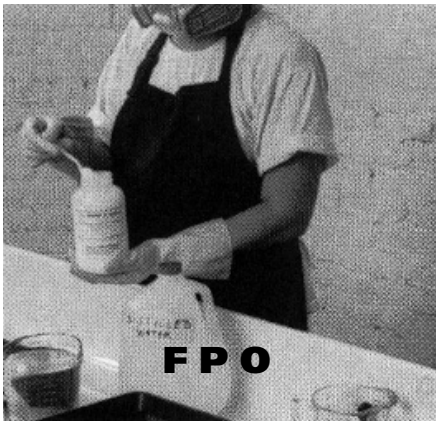
Tips

■ To cut back on the cost of a platinum print and to warm its tones and reduce contrast, palladium sensitizer can be added when mixing the emulsion. The ratio I use is 25% platinum and 75% palladium, but just remember that the total number of drops of the No. 3 sensitizers, which contain the actual metals, should nearly equal the sum of the No. 1 and No. 2 drops used. This formula also reduces solarization (reversal of tones), which is sometimes seen with pure palladium.

■ Two thin coatings yield richer dark tones. My own working method is to add the same number of drops of distilled water as the No. 3 sensitizer to the emulsion. Let the first coating air dry until it is *almost* dry before you apply the second layer. In addition, you can coat a sturdy substrate, expose a negative, process and dry a print, then recoat and reexpose with a different negative, process, and dry.

■ You may find that the same negative prints differently from session to session. Variances in the chemicals used by the paper manufacturer, not the platinum or palladium emulsion, may be the culprit. Try printing on an entirely different paper and see if the same problems in print appearance arise.

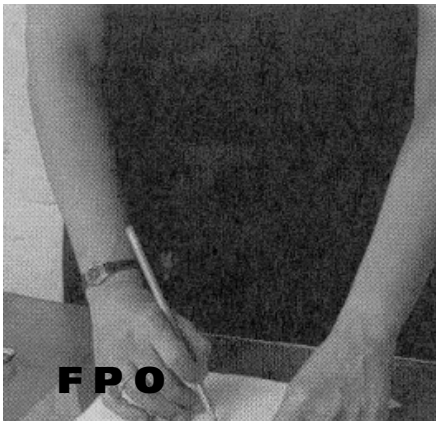
Making a Platinum or Palladium Print



1

Preparing the chemicals

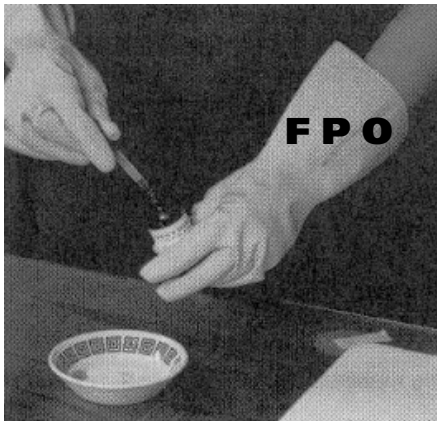
Set up three trays in a sink and mix 1 tablespoon (14 cc) EDTA to 1 qt (0.95 L) distilled water in each. You may find that the powder dissolves more easily in warm water, but use the baths at room temperature. Start to warm the No. 3 sensitizer bottle in a cup of 90°F (32°C) water to dissolve the crystals, but use it at room temperature. Some printers warm the developer at this point, too.



2

Preparing the paper

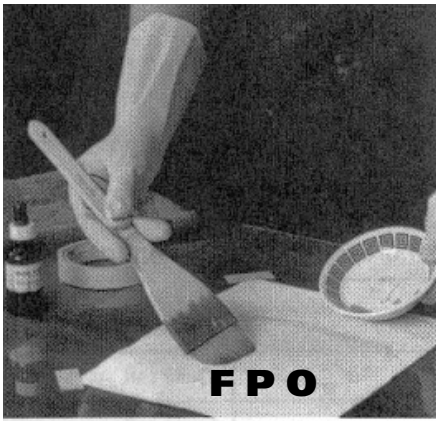
Secure your paper to the coating board. Using a hard (e.g., 2H) pencil, lightly outline the image area. Leave a little extra paper for a test strip and for handling.



3

Preparing the emulsion

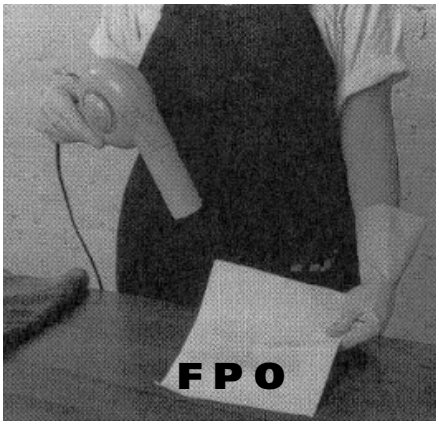
Referring to the chart on page 146, drip the appropriate number of drops for each solution into your cup. If you are employing the double-coat method, add drops of water equal to the amount of No. 3 sensitizer. Watch for crystalline deposits in the No. 3 sensitizer, which you may have to heat up again.



4

Coating the paper

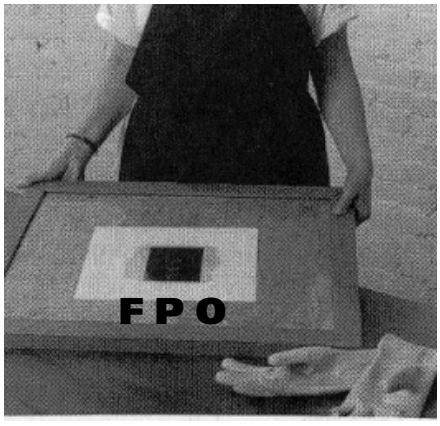
Thoroughly swish the solution together, then, with a predampened brush, quickly and evenly spread the emulsion in one direction. Flip the brush and go back in the opposite direction after each stroke. Next, lightly brush at a 90° angle until the emulsion dulls. Do not worry about streaks. With the remaining emulsion on the brush, coat a swatch for a test strip.



5

Drying the paper

Remove the paper from the coating board and allow it to sit in the dark for 3 to 5 minutes while the emulsion settles in and partially dries. If you are double-coating, apply a second layer of emulsion. Wear a respirator with a toxic dust filter while using a hair dryer on the cool setting to finish drying both sides of the paper.

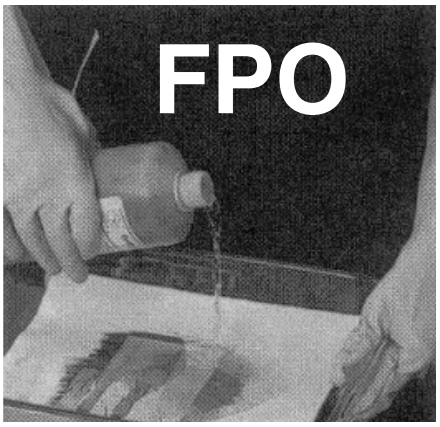


6

Exposing the print

Place the paper, coated side up, on a backing board and position the negative, right-reading, on the emulsion. Lay this unit under heavy glass. Place the loaded print frame in direct summer sunlight for 1 to 5 minutes or under artificial ultraviolet light for approximately 5 to 25 minutes, or until the highlights have detail tone. Different papers will affect the time.

Making a Platinum or Palladium Print *(cont.)*



7

Developing the print

Remove the paper and place it in the developing tray held at a slight angle. Quickly pour developer over the exposed print and swish it around for a few seconds. Or quickly immerse the print completely in a tray of developer.

8

Clearing the print

Place the paper on a piece of Plexiglas angled in a sink. Gently hose the paper with water and then rock it in a tray of running or changing water for 1 minute. Next, gently agitate the paper in three successive clearing baths for 5 minutes each. When the first bath becomes discolored from use, after bathing approximately three 8 × 10 in. (20 × 25.5 cm) prints, discard it. Move the second tray to the first position, the third tray to the second position, and mix fresh clearing agent for the third bath.

9

Washing the print

Drain the print, then use the siphon or tub method to wash it for 20 minutes. Blot excess water from the print with a clean, soft sponge and air dry it on a rack, hang it from a clothesline, or use a hair dryer or fan. Prints dry down considerably darker.

Contrast Control Chart for Platinum and Palladium Printing

Negative contrast	Filter comparison	Solution 1 (# of drops)	Solution 2 (# of drops)	Solution 3 (# of drops)	Platinum paper description
Very high	N/A	24	0	24	Very soft
Quite high	N/A	20	2	24	Quite soft
High	0	18	4	24	Quite soft
Contrasty	1	15	7	24	Soft
Normal	2	12	10	24	Normal
About normal	2½	9	13	24	Normal
Somewhat flat	3	6	16	24	Hard
Quite flat	4	4	18	24	Quite hard
Very flat	5	2	20	24	Very hard
Extremely flat	N/A	0	24	24	For extreme contrast

All values for drops are calculated for an 8 × 10 in. print. Increase the number of drops by approximately 1.5 for an 11 × 14 in. image.

Tips *(cont.)*

■ Liquid ferric oxalate in the No. 1 and No. 2 sensitizers can go bad after 3 months and cause black specks in the coating.

■ To help protect the emulsion from the coating brush's ferrule, you can coat the metal parts of the brush with clear nail polish.

■ If you notice areas of uneven darkness in the finished print, the emulsion might have puddled during coating. Next time, do not allow sensitizer to sit too long in one spot before brushing.

■ For suggestions on coating fabric, refer to the section Cyanotypes on Fabric in Chapter 6.

■ Heated developer warms the tones in a finished print and keeps the constituent chemicals from precipitating out, but it also reduces image contrast. Therefore, to boost the contrast, add more No. 2 solution when mixing the emulsion and increase the exposure time (No. 2 also decreases the light-sensitivity of the emulsion). Hot developer works more quickly. Make sure the test print and the final print are developed at the same temperature.

■ Some printers save used developer, claiming that as it ages it becomes "richer." They pour the developer back every time it collects in the developer tray, replenishing the bottle with fresh developer. In this system, you "top off," or always add enough to bring the total liquid to the same level in the developer bottle. This method is not recommended if you are using gold chloride or EDTA clearing agent. In addition, EDTA is recommended only with slightly acidic developers, such as ammonium citrate; it may not be effective with other developers. EDTA with 1 Tablespoon sodium sulfite and water, however, will clear "topped off" developer.

■ Old developer makes a fine home for slimy mold. I have filtered the mold off and continued to use the developer, but the safest solution is to buy fresh developer.

■ If you are making a pure platinum print, do not use the same replenished developer you used for palladium, and vice versa.

■ Wash the brush out thoroughly between each coating. Emulsion left on the bristles can become exposed and contaminate succeeding prints. To avoid soaking up too much emulsion, partially dry the brush.

■ Splotchy and mottled stains in the finished, dried print can indicate where the emulsion was not thoroughly dry before exposure. Wet emulsion can also ruin your negative. Grainy or mottled highlights can be caused by too much humidity (over 70%). Drying the emulsion on the hot setting of a hair dryer can help reduce the problem, but the temperature should not be above 120°F (49°C) or you may create dark spots in the final print. Condensation from the heat of the hair dryer meeting a cold coating surface can also cause mottling. Storing unexposed, coated paper with silica gel desiccant in an air-tight and light-tight container is advised.

Tips *(cont.)*

■ Exposures will vary according to the negative density, with very dense negatives taking over a half hour. Keep a notebook of each print, its sizing and paper, age of the chemicals, what mixture you used, and exposure time. When you have a similar negative, you will then know where to start. Exposures also will be longer when you use citrate rather than oxalate developer.

■ Streaks in the print that run through shadows, midtones, and highlights may be caused by uneven development and may be particularly prevalent with hot developer. Try to develop the whole print promptly and uniformly next time.

■ Yellow highlights indicate insufficient clearing time or a weak or exhausted clearing bath. Either increase the clearing time, increase the concentration of EDTA, add sodium sulfite, or mix fresh baths.

■ You can clear a print even after it dries, if it has been kept out of light.

■ Fogged (grayed) highlights can be caused from ambient fluorescent or ultraviolet light.

■ Flat, undifferentiated shadow detail can be caused by two problems. The first is a negative that does not have any density in the shadows. If the negative is not so thin that there is no separation in the shadows, you can mix up a more contrasty emulsion and try exposing it again. Another reason could be that the paper is not sized properly, which can increase developing time and prevent thorough clearing, too.

■ Prints dry dark; thus, they look different when wet than when dry.

■ I make test prints before I create a final print. Cut a strip of paper one-third the size of your negative. Coat it with emulsion, dry it properly, then place a part of your negative with shadow detail, highlight detail, and midtones over the strip. Place the unit under glass, but cover two-thirds of it with opaque cardboard. Expose for 5 minutes. Move the cardboard and expose for another 5 minutes. Process the test strip normally, dry it, and then, under a good viewing light, choose a proper exposure for the finished print.

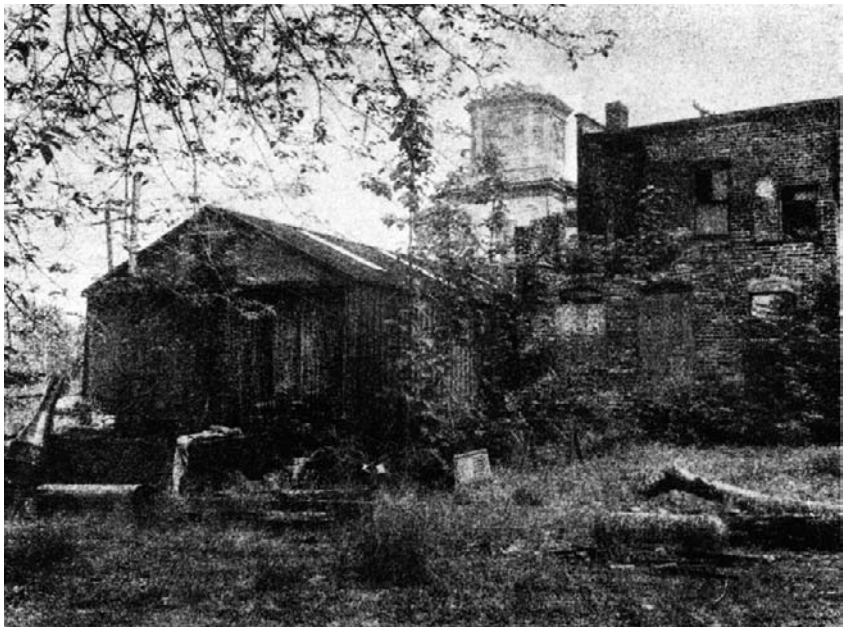
Chapter 11

BROMOIL PRINTS AND CHROMOSKEDASIC PAINTING

BROMOIL PRINTING

Gene Laughter

Bromoil is a photographic control process introduced by C. Welborne Piper in 1907, based on the theories of E. J. Wall. Bromoil was popular among the pictorial photographic salon exhibitors in the first half of the twentieth century. The process gradually lost favor following World War II, as supplies dwindled and as pictorialism gave way to the less romantic and more representational styles of photography.



A bromoil print rendered in a photographic manner, which employed the use of both a brush and a brayer for inking. The silver in the original photograph has been replaced by pigment, resulting in an archival print.

Gene Laughter, a retired advertising executive, owns a fine art photography studio and gallery, The Bromoil Factory, in Richmond, Virginia. Winner of awards for his art work, Laughter is the author of *Bromoil 101* (see Bibliography), founder and past president of the Photographic Art Network of Virginia, and a member of the Bromoil Circle of Great Britain. He has given many talks and workshops on bromoil and is founder of the International Society of Bromoilists. (email: glaughter@earthlink.net.)

Safety

Pigment powders pose little immediate damage from ingestion or inhalation, but repeated exposure to small amounts of some pigments can cause chronic poisoning or other serious effects. To check on the effects of individual colors, read *Overexposure: Health Hazards in Photography*, listed in the Bibliography.

Copper sulfate may cause skin allergies and irritation. Chronic ingestion can cause anemia. Wear a toxic dust mask and gloves.

Potassium bromide in large amounts can cause mental problems and skin rashes. Wear a toxic dust mask and gloves.

Potassium bichromate (also known as dichromate) is highly toxic by inhalation and is a suspected carcinogen. Skin contact may cause irritations and allergies. Wear gloves, goggles, and a toxic dust mask.

For safety guidelines regarding black-and-white photo chemicals, see Chapter 5, Making Negatives.

Naphtha can be highly irritating to the skin and eyes and is flammable. Wear gloves, make sure you have proper ventilation, and store naphtha away from open flames and lit cigarettes.

Method Overview

1 A low-contrast black-and-white photograph is made.

2 The photograph is bleached, tanned, and dried.

3 The original silver image is replaced by applying an oily pigment, such as lithographer's ink. The resultant print can be detailed or impressionistic, grainy or smooth.

Materials

1 Brushes, scissors, and foam rollers. You can quickly and easily make your own brushes by modifying Williams-Sonoma pastry brushes, faux finishing brushes, hog bristle shaving brushes, sash brushes, or artists' brushes. Using sharp scissors or barber's shears, simply trim the bristles at a 25° to 30° angle. Use VMP naphtha for cleaning tiles and brushes (see Care of Bromoil Brushes, later in this chapter). Newspaper also is helpful for cleaning the brushes.

A small 4 in. (10 cm) decorator's foam paint roller purchased at a building supply store may be used for applying and evening out ink and for clearing highlights. The roller also can be used in combination with a brush.

Decorator's foam painting rollers, shaving brushes, cosmetic brushes, artists' brushes, basting and pastry brushes, and faux finishing brushes may be used for applying ink to a bromoil matrix.

2 Ink. Graphic Chemical and Ink Co. No. 1803 crayon black is the most popular ink used by bromoilists. No. 1903 dark brown may also be used, as well as any number of other colors. Each bromoilist may best determine whether to use only black or brown or to add additional colors. Van Son Rubber Base Plus V5151 black printer ink is also very good and is available in many colors at commercial printing supply companies.

Most lithographic inks come in a can, which should be tightly sealed after taking out the small amount to be used for a bromoil session. Take the ink from the can with an artist's spatula by scraping lightly with the blade. Do not gouge into the ink and form holes, which can dry out the contents. Use plastic (electric) tape to seal the lid.

3 Ink modifiers. To stiffen the ink, add a drop of melted candle wax or beeswax, artist's dry pigment from an art store, or magnesium carbonate from a litho supplier. To soften the ink, add a pinhead-size drop of plate oil or linseed oil purchased at an art supply store. A small drop of Canada balsam (see Art Craft Chemistry in the Supply Sources) may be added for more tackiness.

4 Inking tiles and palette knife. Purchase several smooth, white, ceramic, bathroom-type wall or floor tiles in sizes from 4 in. (10 cm) to 12 in. (15 cm) square. Spread the ink on the tile with a palette knife, which can be found with oil painting supplies in an art store.

5 Small rubber brayer. Use a 1½ in. (4 cm) or 2 in. (5 cm) brayer for spreading the ink on the tile in a thin, perfectly smooth layer.

6 Inking support. A piece of beveled plate glass several inches larger than the print makes a perfect support for inking. The support may be tilted to your liking.

7 Photo blotter. Place the blotter on the inking support when drying the front and back surfaces of the bleached print (the *matrix*). Remove the blotter from the support before you begin inking.

8 Soft paper towels or flannel. Use a paper towel folded in quarters for a smooth pad with a flat surface to blot the surface water from the front and back of the matrix.

9 Cosmetic wedge, cotton balls, cotton swabs, or plastic wrap. All of these items can be used to clean a bromoil print.

10 Steel wool. Artists' grade extra-fine steel wool can be used to create texture in the final print.

11 Bleaching and tanning chemicals. Bromoil bleaching kits are available from Art Craft Chemistry or Bostick & Sullivan (see Supply Sources). These kits have premeasured amounts of the requisite dry chemicals, which are added to distilled water to make 1 qt (0.95 L) each of the three stock solutions. You will need three brown bottles for storage. Measure and mix working solutions just prior to bleaching and tanning.

Bromoil bleaching kits make the preparation of the stock solutions simple. No scales are necessary. Pour the contents of each of the three bags into separate 1 qt (0.95 L) bottles and add distilled water to the top of each. Shake vigorously. Wear gloves and a toxic dust mask.

12 Hand-coloring materials. Dry bromoil prints can be enhanced with colored pencils, pastels, Peerless Water Colors, food coloring, and coffee.

13 Photographic paper. Fine bromoil prints can be made on many of today's modern super coated fiber-based papers. Generally, semi-matte papers ink up better than glossy or dead matte ones. A few that have proved to work well for bromoil are Agfa MCC 118, Luminos Charcoal and Tapestry X, Ilford Gallerie FB and MG IV, and Kodak Polymax Fine Art G. In the United Kingdom and Europe, special bromoil papers such as Kentmere Document Art and Bromoil and Bergger Brom 240 are available as well (Kentmere is listed with Luminos in the Supply Sources).

14 Darkroom and black-and-white photo chemicals. Instead of conventional fixer, use a 10% solution of pure hypothiosulfate, available from Art Craft Chemicals, Photographer's Formulary, or Bostick & Sullivan, all listed in the Supply Sources. The simple way to make up a 10% solution is to pour the hypo crystals in a beaker to the 4 oz (118 ml) mark and add this amount to 1 qt (0.95 L) of water. Or, you can use liquid Kodak Rapid Fixer diluted as the manufacturer recommends for paper, but without the hardening solution. (See Chapter 5, in which orthochromatic film is handled in a similar way to photographic paper.)

15 Labeled trays. You will need separate trays for bleaching/tanning and the first soak, and either a tray with a siphon or an archival print washer.

16 Acetate, tape, pencil. Acetate sheets, available from an art store, or old sheets of ortho film are cut with a straight edge and stencil knife. The 2 to 3 in. (5.0–7.5 cm) wide strips should be 3 in. (7.5 cm) larger than the image and taped together at a 90° angle to each other to form an "L" if you plan on darkening edges and corners of the print. KleenEdge or low-tack tape, sold in some building supply stores, is especially easy to use for this purpose.

A pencil is helpful for keeping notes on the back of the print.

Guidelines for Bromoil Printing

Bromoil is a marriage of photography, printmaking, and painting. The printing and processing of the matrix are fairly inflexible procedures. A standard routine should be established and followed. After the matrix is prepared and is ready for inking, however, bromoil becomes a more freewheeling process with great latitude. One cannot properly direct another on how a bromoil print

1

Selecting the image

Select any black-and-white negative that fits your enlarger system. The negative size is not important. The best type of negative for bromoil should not be contrasty but should possess a full range of midtones and detail in both shadow and highlight areas.

2

Making a test print

In a conventional darkroom, make a test strip or a test print on fiber photographic paper to determine the best normal exposure and the optimum times for burning and dodging. This print is useful as a guide when inking the matrix to determine the tonal values and details you wish to bring out in the inking.

3

Make a guide print and process it at the exposure determined in step 2.

4

Exposing the print

Make a print for bromoil by opening up 1 stop more than the exposure for the guide print if you are using super-coated paper (U.S.) or ¼ stop more if you are using non-super-coated paper (U.K. and Europe). Super coating is a hardened antiabrasive layer the manufacturer uses. Leave a safe edge, or white border, of at least 1 in. (2.5 cm) around the bromoil image for ease of handling later.

The print in the accompanying photograph was exposed a full stop more than the test print. The overprinting allows the gelatin of the super coated paper (Agfa MCC 118) to swell sufficiently later in the bromoil process.

5

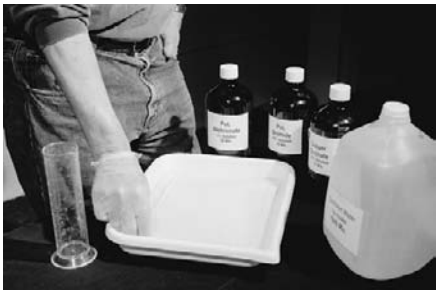
Developing the print

Fully develop the print for 3 minutes in either Ethol LPD, Kodak Dektol 1:9, or Rodinal film developer 1:30. Agitate continuously. Place the print in stop bath for 45 seconds or water bath for 5 minutes, and then fix the print in a bath of 10% solution of sodium hypothiosulfate or liquid Kodak Rapid Fix *without* the hardener added.

6

Washing, drying, and soaking the print

Wash for at least 30 minutes with a siphon washer in a tray or in an archival print washer. Gently blot off any surface water. Air dry for at least 6 hours. Super dry by holding a hair dryer on the hot setting 4 in. (10 cm) above the print until it is crisply dried. Completely soak the print for 5 minutes in a tray of water at room temperature. Drain it.



7

Bleaching the print

Mix a tray of bleaching/tanning solution at working strength from 2⅓ oz (70 cc) of 10% copper sulfate stock solution, 2⅓ oz (70 cc) of 10% potassium bromide stock solution, and 1 oz (30 cc) potassium bichromate stock solution. Add enough distilled water to this mixture to make 1 qt (0.95 L), which will bleach/tan approximately eight to ten prints with an image size of 6 × 8 in. (15 × 20 cm).

Constantly agitate no more than three or four prints at a time while bleaching them for 8 to 10 minutes. Use tongs and gloves.

8

Washing and fixing the matrices

Wash these bleached prints, called *matrices,* for 10 minutes to remove traces of the bichromate.

Fix in a fresh bath of 10% sodium hypothiosulphate solution or Rapid Fix without hardener for 5 minutes. Wash in running water at room temperature for at least 30 minutes. Gently blot off water. Air dry for at least 6 hours. Super dry (step 7) again.

On many papers a faint latent image may be seen. With Agfa MCC 118, one can see a greenish-tan image. If there should be dark brown or black areas, however, you might have exhausted the bleach solution or printed too dark a photograph.

9

Preparing the ink

Place a pea-size blob of lithographic ink on one corner of the inking tile and spread it into a thin layer with the edge of a palette knife, as if you were spreading butter on toast. Using the brayer, spread out the ink into a perfectly smooth square patch on the tile. If you will be applying ink with a brush, roll the ink into a 2 in. (5 cm) square. If you will be applying ink with a roller, the square should be 1 in. (2.5 cm) or so larger than the roller.

10

Preparing the matrix for inking

Soak the matrix in a tray of tap water at 68–75°F (20–24°C) for 10 to 20 minutes. The actual time and temperature of the soak can vary with the degree of hardness of local water and with the photographic paper used for making the matrix. Soak only one matrix at a time, and keep it totally submerged by placing coins or pebbles on the safe edges.

11

Blotting the matrix

Place the matrix on blotting paper and remove every visible trace of surface water from both sides using a folded soft paper towel. Dry the back of the matrix by gently rubbing, and blot dry all traces of water from the emulsion side of the bleached matrix.

12

Inking and resoaking the matrix

Move the matrix, emulsion side up, to a plate glass support angled as needed for your comfort. Apply lithographic ink of the desired stiffness (see Tips). The wrist is used as a fulcrum when inking. See the sections Guidelines for Making Bromoil Prints and Brush Actions for Inking for detailed information on inking techniques.

Evaporation diminishes the differential swelling of the gelatin so that highlights readily and uniformly accept ink, making proper inking increasingly difficult. You may also notice the corners of the matrix beginning to curl slightly. Resoak the partially inked matrix for a few minutes in room-temperature water. During the resoak, reroll the ink on your tile with a brayer to even the ink. Blot the matrix dry again. Continue inking and resoaking until the bromoil print is complete.

Guidelines for Bromoil Printing *(cont.)*

should look; it is an individual, creative process. The tips in this and the following sections will help you get started, however.

Tips

■ The best way to establish the time needed for the soak prior to inking (see step 12) is to cut a matrix into quarters and experiment with inking it after soaking one piece for 10 minutes, another for 15 minutes, a third for 20 minutes, and a fourth piece for 25 minutes. With this test procedure, one can establish the proper lengths of future soaks.

■ Immediately preceding a resoak of the matrix (see step 14), remove any broken hairs or tiny bits of debris on the surface of the print with the pointed end of a kneadable eraser. Form a piece of plastic wrap into a ball and dab any ink blobs or overly inked areas while constantly turning the ball so that a fresh, clean area is always touching the print's surface.

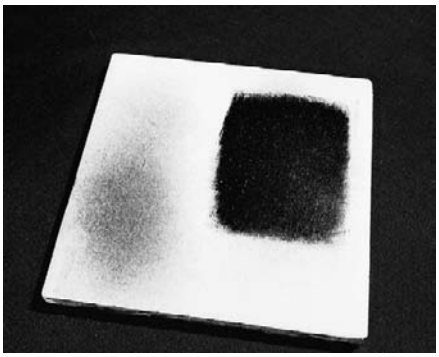
■ Ink may be applied to the matrix either with a brayer, a brush, or a combination of brush and roller. Roller inking is much faster and easier than brush inking and imparts a more photographic, contrasty appearance to the print. The roller action eliminates all grain and softness. Brush inking renders a print with more grain. Many contemporary bromoilists combine the two by first applying a fast, even layer of ink onto the matrix with a brayer, then using the brush for the balance of the inking. Others use a brush for ink application and a roller for evening out the ink and for clearing the highlights.

■ When using a brayer for inking, tape the matrix to the glass with KleenEdge or low-tack masking tape so that the print will not curl around the brayer's roller. Slow rolling with downward pressure applies the ink, whereas rapid rolling with almost no pressure clears the ink and brings in fine detail. Turn the matrix and repeat the procedure with horizontal rolls. Do not be concerned with overall streaks. Return the matrix to its vertical position. Clear the brayer by rolling it onto a clean portion of a large tile until the ink is removed. Then rapidly and lightly use the brayer on the print to roll in all directions. This action clears the print and evens out the ink.

Use a 12 in. (30.5 cm) tile or two smaller tiles when inking with a roller. The darker patch of ink on the tile has been completely smoothed out with a brayer, and the lighter patch is the clearing area. Clear the roller by rapidly rolling on the light area before applying ink to the matrix. This procedure evens out the ink on the roller and allows you to apply a series of very thin ink applications. Do not try to apply too much ink at one time.

Tips *(cont.)*

■ When applying ink with a brush, rapidly and lightly tap the tip of the brush on the tile's smoothed-out ink patch, then tap the brush several times on a clear portion of the tile to even out the ink on the bristles. This second spot is the area you will work from when you place ink on the brush prior to inking the matrix. The first smoothed-out square is your ink reservoir.



The light, perfectly smooth patch on the left is the one from which you will get your ink. Do not go directly from the ink reservoir patch to the print or the brush will have too much ink unevenly distributed in the bristles.

■ You can use a foam roller to clear a brush-inked print, to bring out detail, and to even out any overinking. First, use low-tack masking tape to adhere the matrix to the inking support. With a rapid, extremely light touch, roll the foam roller across the print. If you want to bring back grain after a foam roller clearing, reink the print with a minimum of brushwork.

Clearing. Ink has been applied to the left half of this matrix by slow forceful rolling with a foam roller. The right half has been cleared by rapidly rolling with a foam roller and no pressure.

■ In the latter stages of the inking process, a wet foam paintbrush or wet cosmetic wedge can be lightly rubbed onto the highlights to make them more brilliant and to increase the overall contrast of the bromoil. Do not apply any pressure; just let the weight of the wet wedge or brush do the work. A soaking-wet, soft paper towel also can be used to lightly wipe the entire surface of the inked print for the same purpose. Should more inking be required after this procedure, resoak the matrix and surface dry it before going back to brushwork. Otherwise, the gelatin in the areas that you have rubbed will absorb water and the swelling of the gelatin will be uneven. A wet cotton ball or swab also may be used for clearing small details.

A soaking-wet cotton ball lightly wiped on highlight areas can increase contrast and make the highlights sparkle. If fresh ink is needed after rubbing with the cotton ball, the matrix must be resoaked in water to even out the swelling.

■ To achieve an etching-like quality that emphasizes coarse grain and minimizes detail, use a hog-hair brush with hard ink and a minimum of brushwork. You may find it necessary to add a drop or two of melted candle wax or beeswax to the ink in order to bring it to a proper stiffness. Strive for a bold, broad, overall loose rendering by employing a very rapid brush action followed by a minimum of very light hopping (see Brush Actions for Inking). Use just enough hopping to maintain an even quality of ink on the gelatin. Keep in mind that all ink applications should be applied with the objective of retaining the structure of the coarse grain; hold yourself back on the brushwork! Using crumpled plastic wrap to dab overinked areas can aid in achieving the etching-like appearance.

■ For a more photographic rendering, soak the print in very warm water until the swelling is greater than for hard-ink work. Then use a soft-hair brush with an easy-flowing pigment so that the image easily builds up rapidly. If brushwork is carried too far and too much soft ink is applied, the shadow areas will clog up, which requires one of these remedies: gently dab a ball of plastic wrap on the overinked portion, or place a sheet of tracing paper on top of the image and roll lightly with a brayer until you remove the excess ink. Afterward, even out the ink by hopping with a brush (see Brush Actions for Inking) or rolling rapidly with a clean foam roller.

■ To make soft bromoil brushes for hopping and for applying soft ink without grain, visit the cosmetic department of a discount or beauty supply store and purchase either a blush brush, body brush, or cosmetic brush. Badger-hair shaving brushes also are ideal and readily available. Many artist's brushes are made of soft hair and can be easily trimmed into a stag-foot brush.

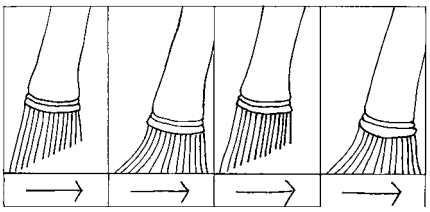
■ When using the walking-and-dragging or pouncing brush techniques (see Brush Actions for Inking), warm up the soak 5–10° and thin the ink if the details are not coming in properly after the initial inking stages. Resoak the matrix for 5 minutes while you rework the ink. Thin the ink by adding 2 pinheads of pure unstiffened ink of the same color. Or, add 1 small drop of plate oil, stand oil, or linseed oil to the ink from a toothpick. Rework the ink with the palette knife and a small, hard brayer.

■ If you plan to reuse the ink on the inking tiles for retouching or reinking within 24 hours, keep the tiles air-proof and prevent the ink from drying out by carefully enveloping them in plastic wrap.

Brush Actions for Inking

Walking and Dragging

The purpose of the walking-and-dragging action is to coat the matrix with an initial thin layer of stiff, greasy ink. Place the toe facing away from you, load the brush with ink, and touch the top left corner of the matrix. Holding the brush firmly at a right angle to the matrix, press down until the heel also touches. Then, relax the pressure and move the brush slightly toward you, leaving a deposit of ink as you go. Repeat this action rapidly but gently while dragging the brush in a line from the top to the bottom of the matrix. When you reach the bottom, the toe of the brush leaves the surface of the matrix for recharging the brush with ink. Otherwise, the toe of the brush never lifts off the matrix. Overlap the original deposit of ink by walking and dragging the brush in a new vertical row. Continue to the bottom, recharge the brush, and repeat the walking-and-dragging procedure until the entire surface of the print is covered with a uniform light layer of ink.



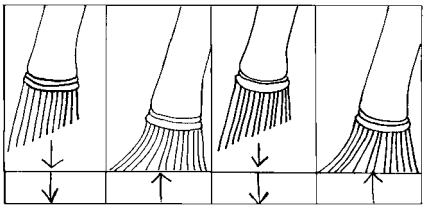
Walking and dragging. The brush is charged with ink, dabbed, dragged, and lifted without the brush completely leaving the matrix surface. The brush is recharged with ink when necessary.

Pouncing

The purpose of the pouncing action is to remove excess ink, thereby creating some contrast; to redistribute previously applied ink from the highlights to the midtones and shadow; and to build up the density of the image with additional ink. The brush is held firmly and vertically to the matrix, but now the stroke starts with the toe of the brush turned away from you and held approximately ½ in. (1.25 cm) from the matrix. With a gentle pouncing action, force the brush hairs to expand until the whole surface of the brush is in contact with the gelatin, then allow the bristles to spring away smartly as the brush returns to its original position of ½ in. from the surface. There is no dragging; the strokes should be carried out briskly, yet gently, in a circular pattern, with each stroke separate but close together. The brush should be recharged with ink after every five or six pounces. Pretend the brush is gently kissing the matrix. No force!

Pouncing is the brush action most often used for general bromoil inking. After walking and dragging, pouncing can also be used without ink on the brush to redistribute ink on the print from highlights to shadows. The walking-and-dragging action and pouncing are used together to build up the density of the ink and increase contrast.

A great deal of wrist action goes into pouncing. The forearm stays in a fixed position and the up-and-down motion of pouncing stems entirely from the wrist. The gelatin matrix is delicate, so do not bounce the forearm, or the force will be transferred to the brush bristles, which results in plugged-up shadows.

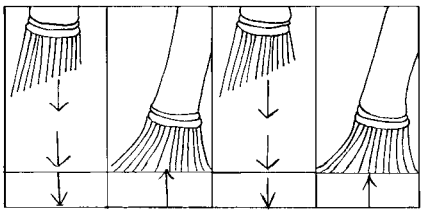


Pouncing. This brush action will clear ink from the highlights and redeposit it in the lower midtones and shadows. Recharge the brush with ink as necessary.

Hopping

The purpose of the hopping action is to bring out the details of the highlights and upper tonal values as well as the shadows, through lightening the inked areas. The brush is held vertically as for pouncing, but now it is held loosely and is allowed to slide through the fingers and bounce vertically off the surface of the matrix. The weight of the brush falling about 1 in. (2.5 cm) onto the matrix is the sole force behind the bristles spreading. Hopping is a bouncing, instead of a pouncing, action.

A more forceful hopping action, dropped from 2 in. (5 cm) above the gelatin surface, should be used with extreme caution. Keep the handle vertical and the toe away from you.



Hopping. You can produce greater contrast and clean the image with this bouncing action. The brush should be cleared of any ink prior to hopping by stippling it on a clean piece of newspaper.

Sweeping

To clear detail in the upper values, a more vigorous variation of the hopping stroke, sweeping, entails gently whisking the bristle tip across the inked gelatin surface. The brush handle is held at the extreme end away from the bristles. The wrist acts as the fulcrum, and the brush swings like a pendulum while a rapid sweeping motion is executed.

Common Bromoil Inking Mistakes

1 Using too much force with the brush when applying ink, thereby destroying detail and creating an uneven and splotchy print.

2 Going too quickly when inking. Have patience or you may lose some subtle aspects of your print.

3 Inking unevenly, which makes dark smudges on the print. This is often caused by failure to consistently smooth out the ink on the tile.

4 Thinking the print is finished when it actually needs more depth of inking. Prematurely stopping the inking results in faint areas on the image.

Common Bromoil Inking Mistakes *(cont.)*

5 Generating a print that lacks contrast and is dominated by an overall muddy look. This common error usually is caused by not performing the inking techniques carefully, not applying a good base of stiff ink first, and not using a wedge to clear the highlights.

6 Plugging up the shadows with excessive ink or ink that is far too soft.

7 Using ink that is too soft for the swelling of the matrix, resulting in blocked-up shadow and highlight detail.

8 Using too much ink on the brush, which creates plugged-up shadows and splotches in the print.

9 Failing to remove every water drop from the front *and* back surfaces of the matrix. This allows moisture to get into the brush bristles and later creates small white spots on the print.

10 Failing to consistently remove small hairs, lint, and bits of trash off the face of the print, causing ink build-up around and over this debris.

Print Finishing and Enhancement

When the bromoil matrix is soaked in water, the gelatin swells, and water retained by the swelling repels the greasy ink. However, when you apply ink to a dry print, the ink will be accepted evenly, both in the highlights and in the shadows. This is a simple concept, but it is also an effective print-finishing technique because selected areas of an image can be strengthened and intensified. You as the bromoil worker have important manipulative controls, such as those listed in the following Tips section.

Tips

■ You can dry an inked print for days or months, then reink it after a long water soak. In this way you can add a new color or obtain consistency in a series of prints.

■ With a semi-dry or totally dry print, you can darken the edges and corners. Tape two acetate straight-edge strips together at a perfect right angle and secure this mask along two of the image's edges as you gently, lightly, and slowly ink the edges of the image. Remember that any overinking cannot be reduced unless you resoak the print and work the problem out with plastic wrap or hopping.

■ Lightly rub the surface of a completely dry and flat bromoil print with a dry paper towel or piece of soft flannel to increase contrast and give the image more brilliancy. Follow up by swabbing the face of the print with a wet paper towel or wet cosmetic wedge. Use a fast, light touch for both rubbing and swabbing.

■ To produce fine striations on the inked surface, use artist's grade extra-fine steel wool that contains no oil. Lightly wipe the surface of the completely dry print. Before you start this procedure, ask yourself, "Will striations enhance this particular image?" If you are not certain, do not do it, for there is no turning back once you have started!

■ Many bromoilists use Marshall's Oil Pencils or Berol Colored Pencils to hand color a bromoil print.

■ Peerless watercolors, designed to sink into the gelatin layer of a photograph, can be used to tint bromoil prints. Their selective application is explained on page 21 of Chapter 2, Hand Coloring. For tinting, add cut pieces of the cardboard color to a tray of water, then soak the entire print in it for approximately 20 minutes.

■ Food coloring, such as that used to dye Easter eggs and cake icing, is available at pharmacies or grocery stores and can also be used for tinting. Mix 8 to 10 drops in 1 qt (0.95 L) of water and add a tablespoon of white vinegar for brilliancy. Pour this mixture into a tray and immerse the bromoil print with a constant, gentle rocking motion. Pull the print out every few minutes until you have achieved the depth of tinting you want, then blot the print dry.

■ Coffee imparts a yellowish-brown shade to the print. Pour a cup or two of drinking-strength coffee at room temperature into a tray with 1 qt (0.95 L) of water. Soak the bromoil in this solution and pull the print out every 2 minutes for inspection. If you overtint, soak the print in fresh water until the coffee leaches out and reaches the tone that suits you. Tea can be used for a different sepia shade.

■ To mount the finished print, first flatten the print by dampening the back and placing it overnight under a piece of glass weighted with books. Or, dampen the back and place the print in a dry mount press for 2 minutes at 200°F (93°C). Mount the bromoil print on 4-ply acid-free board with linen tape hinges. A window over-mat adds protection.

Care of Bromoil Brushes

Use VMP naphtha and a glass artist's brush-cleaning jar fitted inside with a metal coil for rubbing the brush tips. Use artist's brush-cleaning soap only three or four times annually, because it has a tendency to dry the hairs. After cleaning your brushes, hang them to dry with tips facing downward.

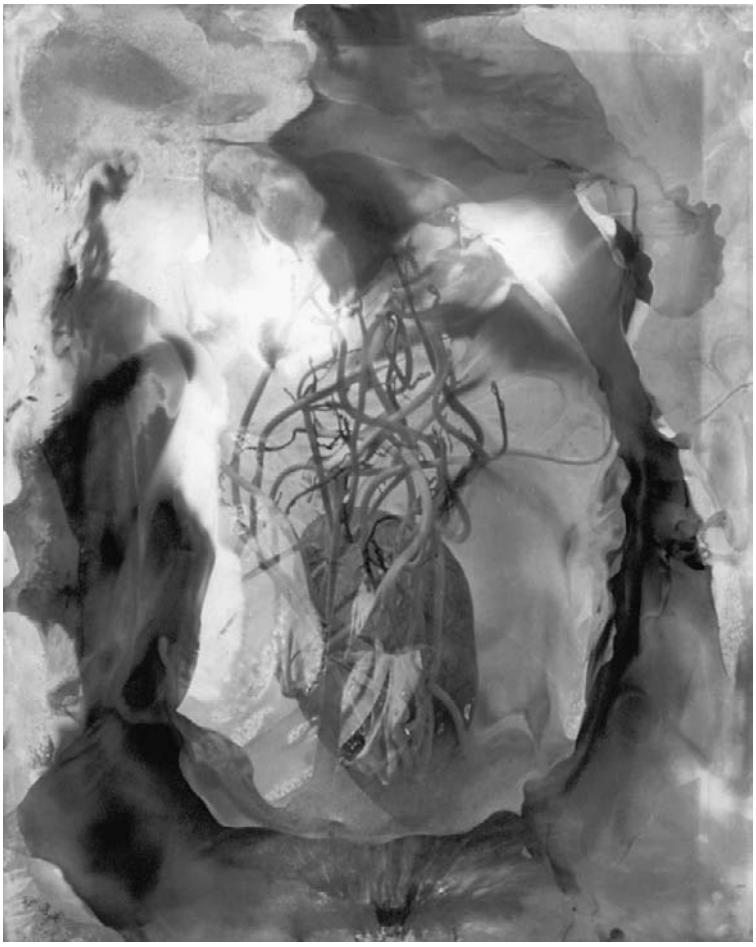
With an ordinary hair comb or a wire brush, comb the bristles of your bromoil brushes prior to use. The teeth of the comb or wire brush separate any hairs that are stuck together and keep the brushes in fine order.

For each brush, make a hooded wrapper. Cut a thin plastic, acetate, or cardboard strip and wrap it around the bristles to hold them in place. Put a rubber band snugly around each brush wrapper. Store the brush in the wrapper after each cleaning to protect it and to keep it in proper shape.

CHROMOSKEDASIC PAINTING

Chromoskedasic, **a term coined by B. W. Rossiter of Kodak, means color by light scattering. Black-and-white photographic papers contain silver salts that form tiny particles when exposed to light and chemicals. Silver particles that are roughly the same size will scatter certain wavelengths of light and absorb others, producing a specific color.**

Artist Birgit Blyth has been applying color photo chemicals to black-and-white photo paper. She was inspired by a November 1991 article in *Scientific American* written by Dominic Man-Kit Lam with Alexandra J. Baran. This section summarizes the article, along with Blyth's advice.



Birgit Blyth, *Untitled,* 16 × 20 in. (40.6 × 50.8 cm) chromoskedasic painting. (Courtesy of the artist.) Prior to painting with chemicals, Blyth enlarged onto Ilford Multi Grade Pearl photographic paper using a negative she had taken of a mature potato that had grown roots. She then applied stabilizer and activator to the paper's emulsion, not knowing exactly what results she would obtain. Blyth is attracted to the chromoskedasic process because of the mystery and experimentation it allows her, a balance between control and surprise. She also uses Luminos Tapestry paper so that she can easily apply oil pastels afterward.

Safety

Make sure you respect the chemicals used in this process; read the Safety section of Chapter 5 (page 65) before you start. Be meticulous about protecting your skin from stabilizer, activator, and acids.

Avoid overheating solutions. Make sure you properly ventilate your darkroom, and wear an approved respirator with an organic vapor and acid gas cartridge. If the stabilizer has formaldehyde, use a respirator with a formaldehyde cartridge as well.

Never pour water into a concentrated acid; instead, carefully add the acid to water.

Materials

Lam advises practitioners to assemble all necessary materials and dilute all needed solutions before removing the photographic paper from its protective box.

1 Darkroom. See Setting Up a Darkroom, pages 64–65, in Chapter 5.

2 Black-and-white photographic paper. Different papers, based on their silver content, yield different results. Warm-tone and cool-tone papers produce slightly different colors.

3 Chemicals. Prepare the following solutions: 1 part Kodak Ektamatic S30 Stabilizer diluted with 9 or 10 parts water at 68°F (20°C); 1 part Kodak S2 Activator mixed with 9 or 10 parts water; and Dektol paper developer or Sprint Print developer diluted to half the working strength recommended by the manufacturer. You will also need stop bath for black-and-white paper, and fixer without hardener (at black-and-white paper strength).

4 Water. For washing the print.

Method

You can start with or without a photographic image. If you want a photographic image, enlarge as you would normally onto photographic paper under safelit conditions. Immediately after you have exposed the paper to the image, do *not* develop and process it, but go to the following paragraph. If you do not care about a photographic image, begin by exposing black-and-white photo paper to dim red light for approximately 5 minutes, then proceed to the next step.

Under a safelight, pour $^1/_4$ to $^1/_2$ cup (59–118 ml) of the 10% stabilizer solution onto the paper and swirl it in a desired pattern. You can see the areas emerge as light yellow. Next, pour a small amount of 10% activator solution followed by a 50% paper developer solution. These chemicals produce reds, oranges, yellows, greens, blues, and grays. Expose the paper to a fluorescent light for 5 minutes; in areas where no chemistry has hit the paper, it will turn pink. Finally, immerse the paper in a bath of fixer for a minute, then turn fluorescent lights on and you can watch the color changes occur. Carefully rinse the paper with water and allow it to dry. Sometimes the colors change further with washing.

There are many possible variations on these directions. For instance, you can selectively administer the color chemicals before enlarging, wash the paper, place Plexiglas or Masonite under it, and then enlarge onto the paper

Method *(cont.)*

and process as you would normally for a black-and-white photograph. Or, if you put the paper in developer with a white light on before you put it in fixer, the paper will turn black where no chemicals have been painted.

Sometimes Blyth begins by applying rubber cement or Maskoid to prevent an area of paper from staining. Then she paints with a brush or sprays the chemicals with an atomizer. Lam suggests using a rag to spread solution or a fountain pen dipped in the activator for drawing an outline. Sometimes he finishes the chemically treated paper by exposing it to fluorescent light for 30 minutes, then he applies a 50% solution of fixer with a spray bottle over the entire piece of photographic paper. After 20 minutes, he washes the paper with water and air dries it. *Wear a high-quality respirator!*

Tips

■ You can purchase liquid stock activator and stabilizer solutions in quart bottles as special-order items at a good photo store.

■ The temperature of the chemicals affects the colors produced.

■ Afterward, Berg toners can be applied over rubber cement masking to further change colors selectively (see Chapter 3, Toning).

■ Luminos Tapestry, or any matte paper, easily takes hand-coloring techniques after being painted chromoskedasically and dried (see Chapter 2, Hand Coloring).

12 ENLARGEMENT EMULSIONS

This chapter concentrates on black-and-white emulsions that can be coated onto a variety of surfaces and handled under an enlarger in a conventional photographic darkroom, yielding a continuous-tone image. Coat-on emulsions are made by Rockland (Liquid Light), Luminos (Silverprint), Cachet (Black Magic), and Porter (U-Spread) in North America, and by Kentmere (SE), Fotospeed, and Jessop (Photo Emulsion) in England. All emulsions can be purchased worldwide. Each has its own characteristics, which are appreciated by its fans. In addition to their capabilities on paper, fabric, glass, metal, and ceramics, all enlargement emulsions can be toned (see Chapter 3) and hand colored (see Chapter 2). (Photo emulsion can be selectively coated onto canvas, then painted into, as shown in Plate XI by Joelle Shefts.) These emulsions do not require a negative the same size as the finished print. They can be purchased premixed in photography stores or ordered directly from the manufacturer (see Supply Sources). They cannot be used in sunlight; a darkroom is required.

Safety

Chapter 5 lists more specific safety recommendations. Make sure your darkroom is well ventilated and that you wear protective gloves when working with the emulsions and photo chemicals.

If you spray, rather than brush, emulsion, use a respirator that absorbs fumes.

Do not ingest, and do not apply the emulsion to your skin. Use hot water and soap to remove emulsion from skin.

Method Overview

1 A negative is placed in the enlarger and focused.

2 In a darkroom, emulsion is coated on the support surface and then dried.

3 The negative is projected onto the sensitized surface, which is processed in photographic chemicals to yield a positive, continuous-tone image.

Materials

1 Image. You can use any black-and-white negative or color negative (the results are less detailed with color negatives) that fits your enlarger system, drawings or photocopies on pieces of acetate slightly larger than the opening in your negative carrier, or real objects such as leaves or flower petals placed in a glass negative carrier. You can even work without an enlarger by contact

***The Fabric of Our Lives,* 1983, 21 × 27 in. (53.3 × 68.6 cm) photo linen and mixed media. Women from Newtowne Court (in Cambridge, Massachusetts), one of the oldest federal housing projects in the United States, worked with the author to create *The Fabric of Our Lives.* This one-of-a-kind oral and visual history book about the project and its residents was created by printing photographic negatives of images and words on Luminos Photo Linen, which was painted, embroidered, embellished, and quilted.**

Materials *(cont.)*

printing the enlarged transparencies you have made for the other light-sensitive processes or placing objects onto a support coated with emulsion, as explained in the Tips section.

2 Emulsion. Liquid Light, Silverprint, and Black Magic are all-purpose, black-and-white variable-contrast emulsions that are readily available in the U.S. They can be purchased in half-pint (236.8 ml), pint (500 ml), quart (0.95 L), and gallon (4 L) light-tight plastic bottles either directly from the manufacturer or from photography stores. Make sure that the instructions are packaged with the emulsion when you buy it. Solid at room temperature, they must be melt-

ed to a usable fluid. One pint covers approximately 16 square feet (1.49 square meters) and can be stored in a refrigerator for up to 2 years. Do not put it in a freezer.

The Rockland Colloid Corporation will make special emulsions, such as a high-contrast one, on special order. They also can ship anti-fog solution and AG-Plus, a high-density emulsion with more silver content for coating glass and clear plastics.

Two other emulsions are on the market: G.A.F. Template Emulsion and Porter's U-Spread Emulsion. G.A.F. does not like to sell directly to the public. Porter's orders its emulsion, which is similar to Liquid Light, from Rockland.

All packages are marked on the outside with an expiration date, but you may want to label the bottle. Make sure it has been kept in a refrigerator where you buy it, then store it cold in your studio. Do not unscrew the cap in white light and do not try to save mixed emulsion.

3 Photographic darkroom and chemicals. You will need a conventional darkroom capable of printing black-and-white photographs; it should include safelights, an enlarger system, variable-contrast filters, a print easel, and four ridgeless trays. Black-and-white paper developer, fixer with hardener, fixer remover, tongs, and a washing system should be used at approximately 68°F (20°C). See the section entitled With a Darkroom in Chapter 5, Making Negatives, for more details. Do not use a stop bath; either use fixer as a stop bath or use water. Avoid rapid fixers because they can bleach the image; use a fixer such as powdered Kodak Unifix or Ilford Ilfofix. Make sure all chemicals remain at around 68°F (20°C) because if the chemicals are too hot, the emulsion will melt during processing.

For large surfaces use a slide projector with either a black-and-white or color negative. Tape opaque black paper over the front of the lens with a hole approximately ⅛ in. (0.33 cm) in diameter cut in the middle to act as a diaphragm limiting the light output and sharpening the image.

4 Receiver. Paper, cloth, and raw canvas need no priming, although most raw canvas needs to be washed before being used. Paper is recommended to practice on, no matter what surface you eventually want to use. You should use rag paper if you care about permanence. The color of the paper, even if it is a bright white versus an off-white, will contribute to the emulsion's appearance.

Smooth surfaces, such as fired ceramics, china, enamelware, glass, and ceramic tiles, should be scrubbed with hot water and washing soda, sal soda, or sodium carbonate (such as Arm & Hammer washing soda, stocked at grocery stores), and 2% chrome alum. The last item is available as an inexpensive "subbing" kit from Rockland and Luminos. More detailed instructions are included with the kit, and a recipe is offered in *Silver Gelatin* (see Bibliography). The preparation must be meticulous and you must leave no fingerprints on the surface. Picceramic (see Supply Sources) sells a photo ceramic kit. Etched glass does not require such extensive preparation—just a good wash. Rocks and seashells usually need little special preparation other than washing and possibly coating with the gelatin sizing mentioned in Chapter 4. I have even used a first layer of watered-down and dried emulsion without any exposure, but with processing. Clean leather, roughed a bit with fine sandpaper, will work. My students have been frustrated working on plaster because it drinks up the photo chemicals used in processing. So, we have tried sealing the surface with varnish and brushing on chemicals. I have successfully coated Silverprint emulsion directly on eggshells with no surface preparation.

Materials *(cont.)*

Another acceptable method for preparing the aforementioned receivers, and the recommended method for metal and preprimed canvas, is a fresh coat with alkyd-based primer. For a transparent finish, spray or brush on satin or gloss finish urethane-based varnish, which can be thinned with mineral spirits. To help prevent air bubbles, coat with a foam brush and sand the dry primer or varnish with very fine sandpaper before applying the emulsion. With aluminum litho plates, you need only degrease with alcohol or acetone. Copper should be neutralized with 3 to 4 oz (88–118 ml) vinegar mixed with 1 qt (0.95 L) water. Dry thoroughly afterward. Do not spray, but seal with a coating of matte polyurethane brushed on. Dry thoroughly again, then apply liquid emulsion. With all these smooth and odd surfaces, let the emulsion set in total darkness for at least 24 hours before using it.

If the receiver is warmed, even with a hair dryer, before coating, the emulsion will spread more easily (see item 8). A pencil is helpful for drawing the area that you want to coat and enlarge onto. To delineate an area where you will place an object under the enlarger, use masking tape.

5 File cards. Available in stationery stores, 3 × 5 in. (7.5 × 12.5 cm) index stock file cards or 3 × 5 in. pieces of the same paper you will be working on can be coated with emulsion and used for testing exposure times and fogging.

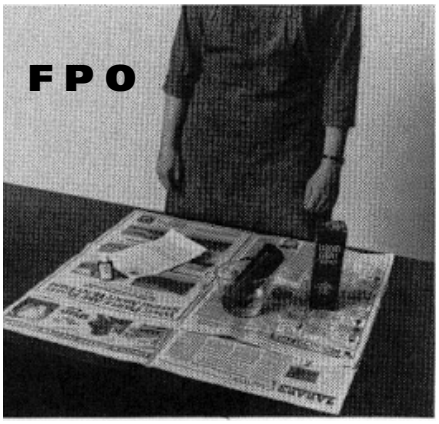
6 Applicators. Emulsion can be applied with house-painting or artists' brushes; it can be rolled onto canvas or paper, poured, dipped into, or sprayed with an atomizer or air brush. Clean utensils after contact with liquid emulsion, and stay away from tools made of copper, brass, bronze, or iron, because they will react with the silver in the emulsion. You will need paper towels to dry the coating brush after it is wet with water and before you apply a new coating.

7 Hot water in beakers. Very hot (200°F or 93°C) water in a beaker or cup is needed to melt the emulsion. Or use an electric heating coil, available at pharmacies and normally employed for boiling water to make coffee. A second beaker of lukewarm water is handy for storing and cleaning used brushes during a printing session; a slightly warm brush makes the emulsion spread more evenly. In addition, emulsion that has not been hardened by fixing can be removed from a surface with hot water. I have a third bowl of hot water into which I set the cup of melted and poured-out emulsion, thus keeping it liquid for the next coating. When I am not using it, I actually rest the brush in the cup in the hot water and cover it with an opaque black plastic bag, such as the ones in which photographic paper are packed. In this way, neither the emulsion on the brush nor the emulsion in the cup fog during a darkroom session.

8 Hair dryer. A hair dryer with a cool setting helps to quickly dry the emulsion. Dry both back and front of paper or fabric. Do not try to dry the emulsion with heat—this actually retards drying by melting the emulsion. You can air dry the emulsion in total darkness. Preheating the support surface with a hair dryer set to hot before you apply the emulsion facilitates an even application.

9 Chlorine bleach *(optional)*. Hardened emulsion can be removed from a surface with solutions such as Clorox or Purex and water. Remove stains from hands with strong soap and hot water. Do not put your hands in fixer, as one manufacturer recommends, because alum hardener may cause skin irritations and allergies, and boric acid (a buffer in fixer) can be very toxic, with systemic effects.

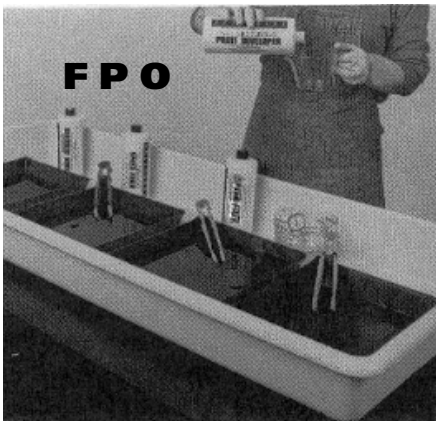
Making an Emulsion Print



1

Melting the emulsion

Cover coating area with newspaper and place a bottle of Liquid Light or other emulsion in hot water, cap down. By gently shaking the bottle, ascertain when you have melted only enough to use. Do not shake the bottle vigorously or you will create air bubbles in the emulsion.



2

Preparing the darkroom

Set up the following chemicals at approximately 60°F (19°C): Dektol diluted 1:2 parts water, two trays of paper fixer with hardener, fixer remover, and water wash.

3

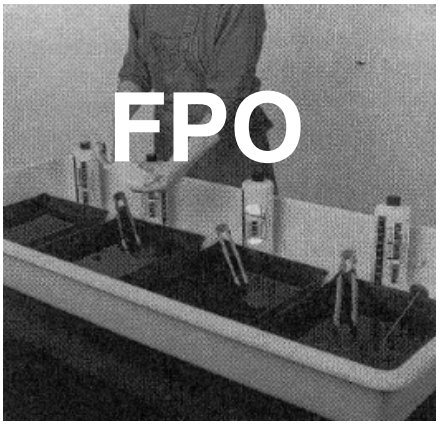
Preparing the test print

Insert the negative into the carrier and the enlarger. With the aperture fully open, focus onto the actual surface you will coat. Trace or tape around the border of the image, then turn off the enlarger light. Adjust the blades of the easel if you are working on paper. If you are coating an object, such as a box, use tape on the enlarger's baseboard to indicate where you will replace the object after removing it for coating. Stop down to the proper f/stop and insert the correct variable-contrast filter.

4

Making test strips

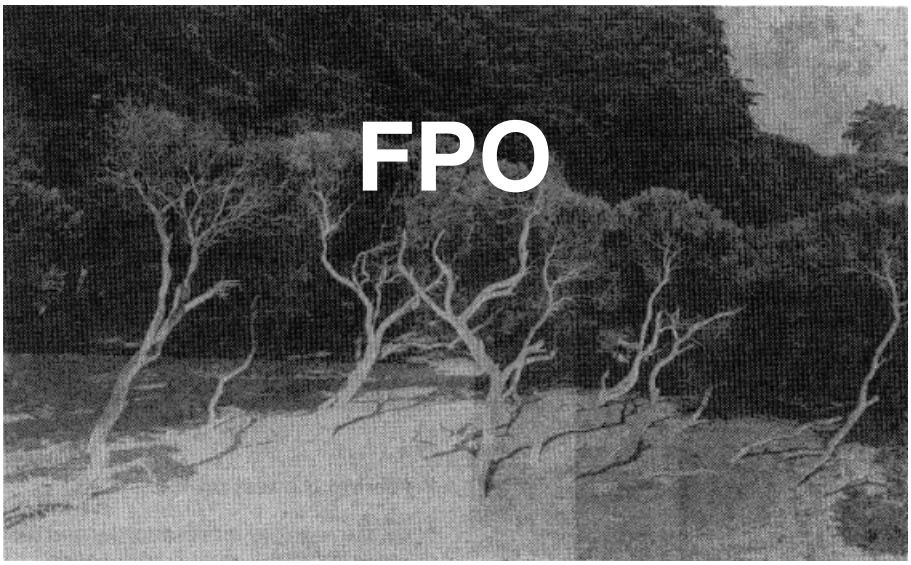
Thinly coat (see Tips on p. 171) and dry the Liquid Light or other emulsion onto a spare piece of the same material as the proposed finished piece. Cover up 4/5 of the coating with cardboard and expose the rest for 10 seconds. Move the cardboard so that 3/5 of the coating is covered. Expose another 10 seconds. Continue in this fashion, covering first 2/5 and then 1/5 of the coating, then remove the cardboard altogether.



5

Processing the test print

Rocking the tray, gently agitate the test print in developer for 2 minutes, in the first fixer for 30 seconds, and in the second fixer for 10 minutes or more. Rinse the excess emulsion off the brush and wipe it dry. Gently rinse the print in water.



6

Inspecting the test print

Under white light, choose the test strip that has the richest blacks and most detailed whites. Keep in mind that you can burn and dodge as you would with conventional photographic paper (see pages 76–77).

7

Making the image

Remove the bottle of emulsion from the hot water and pour a small amount directly onto the desired surface. Spread a thin coating by working the emulsion in with a clean, dry, warm brush. Holding the receiver at an angle to the safelight, you can see whether you have made a thorough coating because wet emulsion is shiny.

Dry the emulsion, place the receiver under the enlarger, and expose it for the predetermined time. Burn and dodge, then process as in step 5. Afterward, use fixer remover for 2 minutes.

8

Finishing the image

Gently wash paper for 30 minutes; wash nonporous receivers for 1 hour. The emulsion is really fragile, so do not allow a stream of water to hit it or you may damage it. Air dry flat.

A wrinkled, dry print can be flattened by ironing on the non-emulsion side or with a dry mount press at 175°F (79.5°C) for 30 seconds.

Tips

■ If you are inexperienced in a darkroom, read the section entitled With a Darkroom in Chapter 5, Making Negatives, to acclimate you to general procedures.

■ Luminos Photo Linen, a sturdy and pliable presensitized fabric, is available in sheets or rolls and is treated in darkroom chemicals, as described for the coat-on emulsions. It is also available from Kentmere in England. Cachet makes Structura Lux Photo Linen, which is distributed by Hans O. Mahn in

Hamburg, Germany, and Calumet in the United States. Fotospeed's photo linen can be obtained from Jay House in Wiltshire, England.

■ Most rocks do not need special cleaning, except ones you find at beaches that are covered with salt. All rocks need a precoat, which is accomplished by mixing one capful of liquid emulsion with 8 oz (236 ml) water and applying this mixture to the rock. Dry it, then intentionally fog this coating by exposing it briefly to white light (a few seconds under the enlarger without a negative), process it in the chemicals, and dry it. Next, apply another layer of emulsion and proceed as described in the step-by-step instructions, starting with step 3.

■ To make a hard, straight-edged coating, first delineate the area with masking or drafting tape, then apply the emulsion up to the tape and even over it, and let it dry. The tape will loosen and pull off in the wash water later, leaving an even boundary.

■ Too thin a coating will often appear as a gray, streaked image. For greater tonal range and richer blacks, apply two or three thin layers, allowing each coating to become almost, but not completely, dry before the next one is applied. Too thick a coating requires longer exposures, and it tends to crack. If emulsion becomes too difficult to spread after it is poured from the bottle, thin it with up to 20% warm water. After running tests with Silverprint emulsion, I have settled on this method: mix 1 part emulsion with 1 part warm distilled water. Coat onto receiver. Let it partially dry, then brush on a second layer of diluted emulsion, stroking in the opposite direction to the first. Dry completely.

■ Add 1 part working developer to 10 parts emulsion and mix thoroughly before coating to create a more sensitive (faster) and more contrasty emulsion.

■ Wipe the mouth of the bottle and the brush after each use. If the emulsion is exposed to white light or sits for more than 10 minutes under the safelight and accidentally mixes in with fresh emulsion, the coating can look fogged and gray. Always replace the bottle cap after each use.

■ Enlargement emulsion is easily affected by age and heat; however, emulsion fresh from the manufacturer is not as light sensitive and may require longer exposure. As it ages, the emulsion will become faster.

■ With odd-shaped objects, you may want to tape a sheet of white paper onto the easel and draw the shape's outline on the paper after you focus the negative. This procedure allows you to reposition the object correctly after removing it from the enlarger area and coating it with emulsion.

■ Enlargement emulsion is not quite as light sensitive as most photographic papers, so keep this in mind as you print.

■ If you are contact printing an enlarged transparency and do not have access to a darkroom, merely flash an overhead tungsten light bulb in a safelighted room.

■ Luminos notes that small bubbles will show as little shiny specks on the dried print. Larger bubbles are more noticeable. The best way of preventing bubbles on the print surface is to make sure the emulsion is free from them in

Tips *(cont.)*

the first place, by skimming the surface. Bubbles seen on the newly coated surface can be burst by touching them with the end of a glass rod that has been dipped in emulsion.

■ If the emulsion bubbles or peels while you are processing the image, make sure you prepared the receiver correctly, did not use an acid stop bath, *did* use a hardener in the fixer, and fixed long enough. Insufficient fixing time or weak or stale fixer also will cause brown splotches. (This is a problem I often see with beginners, and it is amplified by unevenly thick coatings.) Use Hypochek, as described on page 67, to help avoid such problems.

■ Here is a sure-fire bubbleless coating method relayed to me by Bart DeVito of Luminos: 2¼ oz (66.5 ml) emulsion, ¼ oz (7.4 ml) distilled water, and approximately ¼ tsp (1 ml) pasteurized heavy cream. Mix gently with a glass rod under a safelight before coating. Artist Ann Rosen uses this recipe for her prints on Saunders Waterford paper.

■ If the image fades over time, it was not washed long enough to remove the fixer.

■ Enlargement emulsion usually does not need an after-coating, but if moisture or handling will be a problem, finish a dried image with varnish, shellac, lacquer, acrylic spray, or polymer medium. Please read the next tip for a warning about sprays, most of which are not archival and will yellow with age.

■ To dull a glossy print, apply matte spray, available at art supply stores. Sprays can be toxic if inhaled, so a ventilating mask should be worn when you use them.

■ If darkroom chemicals are hotter than 70°F (21°C), the emulsion can melt or smudge.

■ For processing big pictures for which chemical trays may not be large enough to hold the whole image, try either one of these methods:

> After enlarging onto coat-on emulsion, the developer can be applied with a sponge or atomizer to a portion of the print at a time. First, lay the receiver down flat. Then use a clean sponge or atomizer to prewet the emulsion with cool water where you do not want an image, or use Maskoid to prevent developer from attacking that area. The water will slow down the developer so that you can go back into that region after you have applied developer to all other areas. You can continue with this method as you stop and fix the print.
>
> For developing mural-size images on canvas or paper, use different flower troughs, found in plant nurseries, to hold the different chemicals. Make sure the troughs are long enough to fit your canvas or paper. When you are ready to develop the image, you may need someone to help you roll the paper or canvas through the chemicals in one direction, then unroll the paper or canvas through the chemicals and roll to the other end. Wear protective gloves.
>
> In the color insert for this book, Joelle Shefts's method for processing large work is described (see Plate XI).

■ Use of a rapid fixer can cause yellow stains, whereas insufficient fixing time or a weak or exhausted fixer can cause brown stains in the finished print.

■ Enlargement emulsion works beautifully over gum bichromate prints (see Chapter 8).

■ The Rockland Colloid Corporation, manufacturer of Liquid Light, and Luminos, maker of Silverprint, will answer specific questions. Their addresses are listed in the Supply Sources section.

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Mallinckrodt Chemical Works. *The Chemistry of Photography.* St. Louis: Mallinckrodt Chemical Works, 1940. This wire-bound, hard-cover book, which cost 50 cents when published, contains 16 pages of formulas still applicable today for "changing the neutral black image to a more pleasing or more appropriate color."

Marshall, Lucille Robertson. *Photo-Oil Coloring for Fun or Profit.* Washington, DC: Larum, 1944. Could the author be related to Marshall's photo oils?

Martin, Judy, and Annie Colbeck. *Handtinting Photographs.* Cincinnati: North Light Books, 1989.

McKinnis, James. *Handcoloring Photographs.* New York: Amphoto Books, 1994. Showcases color reproductions from many artists.

Murray, Elizabeth. *Painterly Photography: Awakening the Artist Within.* San Francisco: Pomegranate Artbooks, 1993.

Schaub, Grace, and George Schaub. *Marshall's Hand-Coloring Guide and Gallery: The Tools and Techniques Using Marshall's Materials.* Chicago: G & G Schaub Publishers and John G. Marshall Co., a division of Brandess/Kalt/Aetna Group, Inc., 1995.

Wall, Alfred H. *A Manual of Artistic Colouring as Applied to Photographs.* Salem, NH: Ayer. (PO Box 958.) Reprint of 1860 edition. "A practical guide to artists and photographers."

Winser, Cheryl. *The Art of Hand Coloring Photography.* Cincinnati: North Light Books, 1995.

Darkrooms and Negatives

Burkholder, Dan. *Making Digital Negatives for Contact Printing.* San Antonio, TX: Bladed Iris Press, 1998. (http://www.danburkholder.com and danphoto@aol.com)

Duren, Lista, and Billy McDonald. *Build Your Own Home Darkroom.* New York: Van Nostrand Reinhold, 1982.

Eastman Kodak. *Building a Home Darkroom.* Rochester, NY: Eastman Kodak, 1996. Publication KW-14.

Farace, Joe. *Digital Imaging Tips, Tools, and Techniques.* Boston: Focal Press, 1998. Includes a CD-ROM of all steps outlined in the book.

Hearsum, Tim. *Fine-Line Developer.* Rochester, NY: Visual Studies Workshop Press, 1975.

Holter, Patra. *Photography without a Camera.* Yonkers, NY: Van Nostrand Reinhold, 1972. Great ideas for experimental photographers and teachers.

Hutchings, Gordon. *The Book of Pyro.* Granite Bay, CA: Bitter Dog Press, 1992. Available from Bostick & Sullivan, this detailed manual tells all about one of the oldest developing agents treasured by large-format photographers.

Polaroid Corporation. *Darkroom Techniques.* Cambridge, MA: Polaroid Corp.

Seely, J. *High Contrast.* Boston: Focal Press, 1980.

Sesto, Carl. *Designers Guide to Digital Imaging.* New York: Wiley Computer Publishing, 1996.

Wall, E. J., and F. L. Jordan. *Photographic Facts and Formulas.* Englewood Cliffs, NJ.: Prentice-Hall, 1975. Reprint of 1940 text. Tables, recipes.

Zimmerman, Philip. *Options for Color Separations: An Artist's Handbook.* Rochester, NY: Visual Studies Workshop Press, 1980. Bountiful ideas for photographers and nonphotographers for making negatives. Unfortunately, it is out of print.

Cyanotype

Hewitt, Barbara. *Blueprints on Fabric.* Loveland, CO: Interweave Press, 1995. Lots of direct methods for making images. From the co-owner of Blueprints/Printables. (http://www.blueprintables.com)

Klutz Press and the Metropolitan Museum of Art. *Artrageous.* Palo Alto, CA: Klutz Press, 2000.

Ware, Mike. *Cyanotype: The History, Science and Art of Photographic Printing in Prussian Blue,* 2000. Available through Fred & Elizabeth Pajerski, 250 W. 24th St., 4GE, New York, NY 10011, tel./fax 212-255-6501. From the chemist and practitioner who invented a new cyanotype process comes a book of history and information.

Brown Printing

Eastman Kodak. *A Sensitizer for Paper, Cloth and Similar Materials.* Rochester, NY: Eastman Kodak. Ask for (free) pamphlet AJ-5.

Stevens, Dick. *Making Kallitypes.* Boston: Focal Press, 1993.

Gum Bichromate and Kwik Printing

Gassan, Arnold. *The Color Print Book.* Rochester, NY: Light Impressions, 1981. Information on color separation negatives, gum bichromate, and Kwik printing, plus other subjects.

Lewis, Eleanor, ed. *Darkroom.* New York: Lustrum Press, 1977. Chapter on contemporary artist Betty Hahn and her gum prints.

Nadeau, Luis. *Gum Bichromate and Other Direct Carbon Processes.* Fredericton, New Brunswick, Canada: Atelier Luis Nadeau, 1987.

Scopick, David. *The Gum Bichromate Book,* 2d ed. Boston: Focal Press, 1991. Extensive instructions, including negative preparation, color separation techniques, and Kwik printing, in addition to 15 step-by-step instructions to the gum printing process.

Swedlund, Charles, and Elizabeth Swedlund. *Kwik Print.* Rochester, NY: Light Impressions, 1987.

Whipple, Leyland. *The Gum Bichromate Printing Process.* Manuscript at the George Eastman House, Rochester, NY.

Wilson, Helena Chapellin. "Gum Bichromate Printing," *Darkroom Techniques* (June 1981), pp. 40–44.

Platinum and Palladium Printing

Arentz, Dick. *Platinum & Palladium Printing.* Boston: Focal Press, 2000.

Nadeau, Luis. *The History and Practice of Platinum Printing.* Fredericton, New Brunswick, Canada: Atelier Luis Nadeau, 1994. The first printing of this revised edition in English has a tipped-in platinum print. The German-language edition is published by Lindemanns Verlag, Stuttgart, Germany.

Rexroth, Nancy. *The Platinotype,* 2d ed. Yellow Springs, OH: Violet Press, 1977. Available from Photographer's Formulary.

Rice, Ted. *Palladium Printing, Made Easy.* Santa Fe, NM: Eagle Eye Text Production, 1994. Detailed instructions on chemistry, negative making, paper, processing, and finishing for palladium prints. Includes advanced palladium techniques such as toning and the use of different developers. Available only through Photo-Eye. Watch for Rice's forthcoming book on platinum printing from 35 mm and color negatives.

Shillea, Thomas John. *Instruction Manual for the Platinum Printing Process.* Philadelphia: Eastern Light Photography, 1986. Precise instructions, carefully researched with safety data. Available from Photographer's Formulary.

Sullivan, Richard S. *Labnotes.* Van Nuys, CA: Bostick & Sullivan, 1982. Readable and funny instructions on platinum, palladium, and Kallitype, plus generally helpful tips on coating, exposure calculation, and brushes. From half of the Bostick & Sullivan team.

Sullivan, Richard, and Carl Weese. *The New Platinum Print.* Santa Fe, NM: Working Picture Press, 1998. (http://www.bostick-sullivan.com) Also contains good instructions for digital negatives.

Bromoil and Chromoskedasic

Laughter, Gene. *Bromoil 101, A Plain English Working Manual and User's Guide for Beginners in the Bromoil Process.* Self-published, 1997. Available from the author at 8714 Wishart Road, Richmond, VA 23229 and from Photo-Eye Books, Bostick & Sullivan, and Creative Monochrome Ltd. (see Supply Sources).

Laughter, Gene, "Basic and Advanced Bromoil Inking" (video). Available from author at address listed above.

Lewis, David W. *The Art of Bromoil and Transfer.* Self-published, 1995. Available through Photo-Eye, Photographer's Formulary (see Supply Sources) and A Photographer's Place (P.O. Box 274, Prince St. Station, New York, NY 10012-0005; Tel: 212-941-7920).

Nadeau, Luis. *History and Practice of Oil and Bromoil Printing.* Fredericton, New Brunswick, Canada: Atelier Luis Nadeau, 1985.

Neblette, C. B. *Neblette's Handbook of Photography and Reprography: Materials, Processes and Systems.* New York: Van Nostrand Reinhold, 1977. The only book I know of besides this one with instructions on chromoskedasic painting.

Enlargement Emulsions

Eastman Kodak. *Making a Photographic Emulsion.* Rochester, NY: Eastman Kodak. Pamphlet AJ-12. Out of print, but you might be able to find it in a photo store.

Morgan and Morgan. *The Morgan and Morgan Darkroom Book.* Dobbs Ferry, NY:

Morgan and Morgan, 1980. Includes a chapter on Liquid Light.

Reed, Martin, and Sarah Jones. *Silver Gelatin.* New York: Amphoto Books, 1996. Not a stone left unturned in this text.

Related Processes

Bunnell, Peter. *Non Silver Photographic Processes: Four Selections, 1886–1927.* New York: Arno Press, 1973. Reprint of original manuscript on photogravure, gum bichromate (by DeMachy), oil and bromoil processes, and platinotype (platinum print).

Croner, Marjorie. *Fabric Photos.* Loveland, CO: Interweave Press, 1989.

Davies, Adrian, and Fennessy, Phil. *An Introduction to Electronic Imaging for Photographers.* Boston: Focal Press, 1994. Digital imaging in down-to-earth language. Includes copyright-free CD-ROM, playable on both Macintosh and Windows computers.

Ephraims, Eddie. *Creative Elements: Darkroom Techniques for Landscape Photography.* New York: Amphoto Books, 1993.

Hedgecoe, Johen. *The Photographer's Handbook.* New York: Alfred P. Knopf, 1995. From A (ambrotype) to Z (zoom lenses), a brief explanation of everything photographic.

Koenig, Karl P. *Gumoil Photographic Printing.* Revised edition. Boston: Focal Press, 1999.

Kolb, Gary P. *Photogravure: A Process Handbook.* Carbondale, IL: Southern Illinois University Press, 1986.

Laury, Jean Ray. *Imagery on Fabric: A Complete Surface Design Handbook.* Lafayette, CA: C&T Publishing, 1997. Excellent environmental and health precautions, as well as chapters on light-sensitive coatings. Recommended by Jennifer Priestly of Fabrics To Dye For (see Supply Sources).

Nadeau, Luis. *Modern Carbon Printing.* Fredericton, New Brunswick, Canada: Atelier Luis Nadeau, 1986.
Reilly, James M. *The Albumen and Salted Paper Book.* Rochester, NY: Light Impressions, 1980.
Renner, Eric. *Pinhole Photography: Rediscovering a Historic Technique.* Boston: Focal Press, 1995.
Sims, Ami. *Creating Scrapbook Quilts.* Flint, MI: Mallary Press, 1993.
Sobieszek, Robert A., ed. *The Collodion Process and the Ferrotype: Three Accounts, 1854–1872.* New York: Arno Press, 1973.
Sobieszek, Robert A., ed. *The Daguerreotype Process: Three Treatises, 1840–1849.* New York: Arno Press, 1973.

Magazines and Journals

The Alternative Photo Review
Alt Press
6, Penwith Business Center
Long Rock, Penzance
Cornwall TR20 8HL
United Kingdom
Tel: 01736 330200
E-mail at tapr@compuserve.com

Camera Arts
Steve Simmons Inc.
1400 S Street, Suite 200
Sacramento, CA 95814
Tel: 916-441-2557
http://www.camerarts.com
Quality reproductions, darkroom and digital articles, equipment and product reviews.

Camera and Darkroom Photography
P.O. Box 271309
Escondido, CA 92027
It was good while it lasted. Your library may have old issues.

Fiberarts
50 College Street
Asheville, NC 28801
Geared toward artists/craftspersons, the magazine has published articles on photo-printing on fabric and related subjects.

Photo Techniques (formerly *Darkroom & Creative Camera Techniques)*
Preston Publications Inc.
6600 West Touhy
Niles, IL 60714-4588
http://www.phototechmag.com
Bimonthly, usually with one article related to photo printmaking.

PhotoVision Magazine
Subscriptions
P.O. Box 280808
Lakewood, CO 80228
Fax: 303-987-0198
email: pvsubmail@aol.com

Test
Polaroid Corp. See Supply Sources for contact information.

View Camera Magazine
"The journal of large-format photography," published by the folks involved in *Camera Arts* (see above).

The World Journal of Post-Factory Photography
Post-Factory Press
61 Morton St.
New York, NY 10014
E-mail: editor@post-factory.org
Edited by knowledgeable, spunky, and humorous Judy Siegel. Each issue focuses on a process and examines its contemporary practice and history and provides abundant amounts of the latest technical information.

Health and Safety

If you have questions about materials you are handling, call your local Department of Public Health. Other organizations you can contact are as follows:

The Art and Craft Materials Institute, Inc.
715 Boylston Street
Boston, MA 02116

Artists Health Education Project
c/o Massachusetts Cultural Council
Boston, MA 02110

Arts, Crafts and Theater Safety
181 Thompson St., #23
New York, NY 10012
Attn.: Monona Rossol
Publishes a monthly newsletter updating health and safety issues by the co-author of the authoritative book *Overexposure,* listed below under "Shaw."

Center for Safety in the Arts
5 Beekman Street
New York, NY 10038
Publishes a monthly newsletter, *Art Hazards News,* and answers questions.

Ilford 24-Hour Emergency Response Hotline
800-888-8372 (USA)

Kodak 24-Hour Hotline
800-242-2424 (USA) or
Kodak, Ltd.
Harrow, England
01-427-4280 (England, Europe, Africa)
www.kodak.com

OSHA Publications Office
Room N-3101
200 Constitution Ave., NW
Washington, DC 20210

The following publications also instruct artists on safety issues:

Barazani, Gail Coningsby. *Safe Practices in the Arts & Crafts: A Studio Guide.* New York: The College Art Association of America, 1978.

Clark, Nancy, Thomas Cutter, and Jean-Ann McGrane. *Ventilation: A Practical Guide.* New York: Center for Occupational Hazards, 1984.

Eastman Kodak. *Safe Handling of Photographic Chemicals.* Rochester, NY: Eastman Kodak, 1979. Request (free) pamphlet J-4, or *Disposal of Small Volumes of Photographic Processing Solutions* (pamphlet J-52).

McCann, Michael. *Health Hazards Manual for Artists.* New York: Nick Lyons Books, 1985.

McCann, Michael. *Artist Beware.* New York: Lyons & Buford, 1992.

Sax, N. Irving. *Dangerous Properties of Industrial Materials.* New York: Van Nostrand Reinhold, 1975.

Shaw, Susan, and Monona Rossol. *Overexposure: Health Hazards in Photography,* 2d ed. New York: Allworth Press, 1991. Absolutely the most thorough, well-organized book on health, safety, and legal issues in photography. Should be required reading in order to make intelligent and informed choices about your materials and procedures. In the United States, call the authors' hotline with questions: 212-777-0062.

Worker's Compensation Board. *WHMIS Core Material: A Resource Manual.* Richmond, British Columbia, Canada. An inexpensive guide to Canadian health and safety requirements.

Internet

For those of you connected to the Internet, printmaker and author Luis Nadeau recommends ALT-PHOTO-PROCESS-@VAST.UNSW.EDU.AU. He also invites written inquiries into his research center and museum, where he will in the summer open his nonsilver print collection and library to researchers. Contact Luis Nadeau, Box 7, Site 4, RR#4, Fredericton, New Brunswick, Canada, E3B 4X5.

Other sites include the following:

The Alternative Photographic Process FAQ (Frequently Asked Questions), http://duke.usask.ca/. The FAQ includes information about subscribing to a daily exchange, sometimes with the authors of the books in this bibliography: subscribealt-photo-process-1. The archives of this list are a great resource, and you may find many of your questions answered in the discussions there: http://www.webcom/gwalker/altphoto/.

http://www.bostick-sullivan.com for information in the United States about the Alternative Photographic International Symposium (A.P.I.S.), and http://www.bostick-sullivan.com/rappp/rapp.htm for Registered Alternative Photographic Person worldwide updates and database.

kingnapoleonphoto@compuserve.com for A.P.I.S. information in Europe

http://www.davidmichaelkennedy. Lots of information regarding alternative processes, including detailed instructions on making enlarged negatives with panchromatic film.

http://www.lightfactory.org. Condensed instructions on photo processes, workshops.

http://www.workingpictures.com/links/. For platinum printing information.

http://home.earthlink.net/~trans 40/hopperlist/. For a master list of bromoil Web sites.

http://alt-photo.com/alt-photo/bromoil/index. Home page of the International Society of Bromoilists.

Health and Safety Products

Please refer to the bibliography for organizations and books to assist in your selection of safety products.

Drager Sicherheitstechnik GmbH
(of Lab & Occupational Safety)
Revalstrasse 1
D-23560 Lobeck
Germany
Tel: 49 4518820
Fax: 49 451882-2080
http://www.draeger.com
Respirator masks and diver's neoprene gloves

General Scientific Safety
525 Spring Garden St.
Philadelphia, PA 19123
Tel: 213-922-5716; 800-523-0166

Lab Safety Supply
P.O. Box 1368
Janesville, WI 53547-1368
Tel: 800-356-0783
Fax: 800-543-9910
Safety tech line: 800-356-2501
Outside U.S. and Canada: 608-754-7160
http://www.labsafety.com
Online catalog and ordering available.

Photo-Printmaking Products

Agfa-Gavaert, Inc. (of Bayer Corp.)
100 Challenger Road
Ridgefield Park, NJ 07660
Tel: 201-440-2500; 800-926-2432

Antec, Inc.
721 Bergman Ave.
Louisville, KY 40203
Tel: 502-636-5176; 800-448-2954
Fax: 502-635-2352
E-mail: info@kyantec.com
Has a special list of chemicals for alternative processes. Other needed chemicals are available in their regular catalog in 25 g increments.

Art Craft Chemistry
P.O. Box 583
Schenectady, NY 12301
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Order only: 800-682-1730
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Most alternative photo chemicals, including bromoil blea kits. Monthly specials.

Atlantis European Ltd.
146, Brick Lane
London E1 6RU
United Kingdom
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Fax: 0171 377 8850
Selection of Escoda brushes, pigments, and paper for br and other processes.

Berg Color Tone, Inc.
72 Ward Road
Lancaster, NY 14086
Tel: 716-681-2696
Fax: 716-684-0511
http://www.bergcolortone.com
In addition to toners, Berg makes gold protective solution, l es, dehardener, Berg Bath, *From Black & White to Cr Color,* and retouching kits. To stock Berg products, your dealer should contact Tiffen LLC (716) 328-7800.

Blueprint/Printables
(See Fabric Suppliers)
They also sell cyanotype precoated on 90 lb watercolor and decently priced blueprint chemicals, as well as the listed under their entry in the Fabric Suppliers section.

Bostick & Sullivan
P.O. Box 16639
Santa Fe, NM 87505-8748
Tel: 505-474-0890
Fax: 505-474-2857
http://www.bostick-sullivan.com for online catalog
E-mail: orderinfo@ earthlink.com
They ship dry chemicals for all processes in this book, pre kits for platinum and palladium printing, glass coating plus equipment, books, and rag papers. Check out Ziatype process; kits for cyanotype, Van Dyke, gum, and type printing; terrific and relatively inexpensive print f

and exposure units; HOBO 5 × 7 and 8 × 10 point-and-shoot cameras; and bromoil supplies. Call them (it's a family affair) for technical advice and for information regarding the yearly Alternative Photo International Symposium. They are personable and knowledgeable.

Brandess/Kalt/Aetna Photographic Distributors
5441 North Kedzief
Chicago, IL 60625
http://www.bkaphoto.com
They are wholesalers of Premier contact printing frames, Marshall's hand-coloring products and Extra Strong Colors, Retouch Method toners, Rockland Liquid Light, and darkroom apparatus. Ask your camera store to order from them.

Bryant Laboratory, Inc.
1101 Fifth St.
Berkeley, CA 94710
Tel: 510-526-3141; 800-367-3141
Fax: 510-528-2948
E-mail: bry_lab@sirius.com
They will ship small or large quantities of chemicals within the United States.

Calumet
890 Supreme Drive
Bensenville, IL 60106 (and other locations)
Tel: 800-225-8638
Fax: 800-577-3686
International tel: 630 860 7447
International fax: 630 860 7105
http://www.calumetphoto.com/
Cachet Black Magic, Rockland Liquid Light, toners, color photo pens, Marshall's oils and pencils, NPC Polaroid film back for 35 mm and 2¼ in. cameras, and Polaroid supplies and camera backs. They also offer photo workshops and a studio for 20 × 24 in. Polaroid in San Francisco (http://www.mammothcamera.com), where you can make huge transfers.

Canadian Laboratories Supplies, Ltd.
10989-124th St.
Edmonton, Alberta or
Halifax, Nova Scotia; Montreal, Quebec; Toronto, Ontario; Vancouver, British Columbia; Winnipeg, Manitoba
Canada

Canson-Talens, Inc.
21 Industrial Way
South Hadley, MA 01075
Tel.: 800-628-9283
U.S. distributor of Platine paper.

Creative Monochrome Ltd./ISCM
Courtney House 62, Jarvis Rd
South Croydon, Surrey CR2 6HU
United Kingdom
Tel: 0181 686 3282
Fax: 0181 681 0662
E-mail: roger@cremono.demon.co.uk
CMDirect-Fotospeed Alt Kits, replacement bromoil ir brushes, Laughter's *Bromoil 101,* general photograph plies.

D.F. Goldsmith Chemical & Metal Corp.
909-A Pitner Ave.
Evanston, IL 60202
Tel: 302-869-7800 (collect calls accepted)
The least expensive source I know of for silver nitrate. $ imum order required.

Eastman Kodak Co.
Rochester, NY 14650
Tel: 800-242-2424
http://www.kodak.com
Manufacturer of ortho film, ortho glass plates, darkroom cals, toners, and other photography products. Kodak p es inexpensive pamphlets, including one on brown (see page 177), and *Making a Photographic Emulsion* f (pamphlet AJ-12).

Edwards Engineered Products
5304 Arrowhead Dr.
Lago Vista, TX 78645-5803
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Ultraviolet light sources, coating tubes, and even mec tray agitators.

Falkiner Fine Papers
76 Southampton Row
London WC1B 4AR
United Kingdom
Tel: 44 020 7831 1151
Fax: 44 020 7430 1248

Freestyle Camera Co. (formerly Freestyle Sales)
6400 Sunset Blvd.
Los Angeles, CA 90027
Tel: 323-660-3460; 800-292-6137
Fax: 323-660-4885
http://www.freestylecamera.com
They ship, UPS postage free (in the 48 continental states) expensive lith film, such as Aristatone, under their ow plus enlargement emulsions, darkroom supplies, phot plates, and Marshall hand-coloring supplies. Ask f Alternative Process, Printmaking, Photography catalog log@freestylecamera.com and information at info@fr camera.com.

Fuji Photo Film U.S.A., Inc.
1285 Hamilton Parkway
Itaska, IL 60006
Manufacturer of Fujilith Ortho Film and Fujilith High Duplicating Film.

Graphic Center
P.O. Box 818

Ventura, CA 93002
Tel: 805-383-6864
http://www.Box818.com
E-mail: GraphicCtr@aol.com
If it was made by or for Polaroid, they have it, including old cameras, refurbished cameras, and inexpensive Polaroid copy stands with close-up lenses. Free catalog.

Graphic Chemical and Ink
Tel: 800-465-7382
http://www.graphicchemical.com/graphicchemical.store
Online catalogue with bromoil supplies.

Great Basin Photographic
HCR 33 Box 2
Las Vegas, NV 89124
Tel: 702-363-1900
Fax: 702-363-4490
http://www.greatbasinphoto.com
Solidly hinged, felt-lined printing frames of walnut, oak, or maple. Custom and standard sizes: 8 × 10 in. up to 16 × 20 in. come with double-strength glass; 20 × 24 in. has $\frac{3}{4}$ in. glass. Banquet camera film holders.

W. B. Hunt Co., Inc.
100 Main Street
Melrose, MA 02176
Tel: 781-662-8822
Mail order: 800-924-8682
Fax: 781-662-6524
Books, Polaroid materials, hand-coloring supplies (including Marshall's and Cass), black-and-white darkroom chemicals, brushes, nonsilver supplies, N.P.C. Polaroid camera backs for 35 mm and $2\frac{1}{4}$ in. cameras, Luminos Silverprint, Cachet Black Magic, some kits from Photographer's Formulary. Open seven days a week! They will ship to any country that UPS or Federal Express services. Free catalog.

Hunter Penrose Ltd.
32, Southwark St.
London SE1 1TU
United Kingdom
Tel: 0171 407 5051
Fax: 0171 378 1800
Printmaking supplies for bromoil.

Intaglio Printmakers
62, Southwark Bridge Rd.
London SE1 OAS
United Kingdom
Tel: 0171 928 2633
Fax: 0171 928 2711
Litho inks, paper, and etching presses for bromoil.

Italian Art Store
84 Maple Ave.
Morristown, NY 07960
Tel: 800-643-6440
Jumbo sash brushes for bromoil.

Jay House Ltd.
Fiveways House
Rudloe, Corsham
Wilts SN13 9RG
United Kingdom
Tel: 01225-810596
Fax: 01225-811801
E-mail: Fotospeed_U.K@compuserve.com
Recommended by Luminos for their Fotospeed Van Dyke, otype, bromoil, gum, palladium, and platinum kits, and linen.

Johnson Matthey PLC
Orchard Rd.
Royston Herts SG8 5HE
United Kingdom
Tel: 01763-44161
Chemical supplier (industrial). Chemicals sold in standard aging and larger quantities.

Kimberly-Clark
1285 Avenue of the Americas
New York, NY 10019
Tel: 212-554-4252; 800-233-1658
They are the sole distributor in the United States of Ki Plastic sheets for Kwik printing, but their product manag tell you where it can be purchased worldwide.

Lambert Co., LLC
194 Vanderbilt Ave.
Norwood, MA 02062
Tel: 781-440-0842; 800-292-2900
They will ship Sera Screen Transparent Base #174 and otl materials within the United States. They sell ultraviolet sure units, masking sheets, rubylith tape, and lint-free V pads.

T.N. Lawrence
117-119, Clerkenwell Rd
London EC1 5BY
United Kingdom
Tel: 0171 242 3534/ 0170 405 4225
Fax: 0171 430 2234
38 Barncoose Industrial EstatePool, Redruth, Cornwall 3QR
United Kingdom
http://www.lawrence.co.uk
Supplies for artists/printmakers: litho inks, rollers, and pap

David W. Lewis
457 King St.
P.O. Box 254
Callender, Ontario POH 1HO
Canada
Tel: 705-752-3029
E-mail: dlewis@onlink.net

More than ample choices of oil bromoil brushes, color pigments, chemicals, bromoil papers, and transfer presses, as well as *The Art of Bromoil and Transfer* (see Bibliography).

Light Impressions Corp.
439 Monroe Ave.
P.O. Box 940
Rochester, NY 14603-0940
Tel: 800-828-6216
Fax: 800-828-5539
http://www.lightimpressiondirect.com
They carry Marshall's hand-coloring supplies, color spotting pens, and conservation papers.

Luminos Co.
25 Wolffe
P.O. Box 158
Yonkers, NY 10705-0158
Tel.: 800-431-1859
Kentmere Ltd.
Steveley, Kendale
Cumbry LA89PB
United Kingdom
Tel: 05 39 821 365
Both companies can supply you with Luminos Photo Linen. In addition, Luminos manufactures textured or colorful (glossy red, green, yellow, pastel blue, gold, and silver) photo papers and grades 2 and 3 Art RC black-and-white photo paper for hand coloring. They sponsor the Luminos Printmaking Guild, which for an annual fee offers subscribers instructions for a variety of techniques, samples of products, members-only contests, a Free Paper Program, and a newsletter. Kentmere also sells terrific bromoil paper.

TheMagicTouch
Robert-Bosch-Strasse 8
63477 Maintal
Germany
Tel: 49 6181 402 990
Fax: 49 6181 402 9999
E-mail: markus@themagictouch.com
http://www.themagictouch.com
You can purchase transfer sheets that use color and black-and-white copying technology to relocate imagery on paper, fabric, ceramics, wood, metal, and glass. They also sell heat press equipment, mugs, and (of course) steins.

McManus and Morgan
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An art store that specializes in papers. Thousands to choose from.

The New Pictorialist Society
7155 Rivol Rd.
West Hills, CA 91307
This nonprofit corporation is a resource for information history, philosophy, and processes of classic pictorial raphy, many of which are described in this book.

Palladio and New American Platinotype Co.
P.O. Box 400028
Cambridge, MA 02140
Tel: 800-628-9618
Fax: 617-547-6810
Tech support: 617-547-8703
As of the writing of this book, Palladio has temporarily making machine-coated platinum/palladium paper requisite processing chemicals and cyanotype on rag p the roll. You should check to see if those products are production, but they still have exposure units and fram legs.

William Paul & Associates, Ltd.
16 Yellowstone Ave.
White Plains, NY 10607
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Fax: 914-761-0508
E-mail: wmpaulltd.@aol.com
One of the largest mail-order suppliers of discount ortl including duplicating film for enlargers and graphic for stat cameras; they have specials every month.

Pearl Paint
308 Canal St.
New York, NY 10013 (and other locations)
Tel: 212-431-7932 (international); 800-221-6845 (dome
http://www.pearlpaint.com
Seems like endless aisles of almost any marking tool (in Marshall's), paper (including discount prices on Platine d'Arches), and brushes.

Peerless Color Laboratory
11 Diamond Place
Rochester, NY 14609
Tel: 716-288-7460
Fax: 716-288-3854
E-mail: kbaron@eznet.net
http://www.peerlesscolor.com
Manufacturer of Nicholson's Peerless Transparent Wate in sheet and liquid form for over 115 years. They pr Complete Edition Book with 15 color sheets or t Edition Book with the same 15 colors in smaller Individual sheets and liquids are available in over 20 ent colors.

The Photographer's Formulary, Inc.
P.O. Box 950
Condon, MT 59826
Tel: 800-922-5255
Fax: 406-754-2896
E-mail: fomulary@montana.com
http://www.photoformulary.com
They supply small or large quantities of numerous che plus instructions explaining principles and theories fo

printmaking processes as well as black-and-white and color photography. Also some books and apparatus (beakers, thermometers, etc.). The most reliable source I know of for chemicals for all the light-sensitive techniques. They also run summer workshops in techniques for black-and-white photography and many of the processes in this book in an area of Montana "boasting some of the best wilderness lands in the Rocky Mountains" (see http://www.workshopsinmontana.com).

Picceramic Co.
817 Ethel Place
Vestal, NY 13850
Photo ceramic kit for firing.

Platinum Press
20 Maplewood Lane
Madison, CT 06443
Tel: 203-245-7674
They sell Platine paper, custom-built exposure units, and coating tubes. Owner Martin Axon will give technical support and sell custom-made digital negatives to customers.

Polaroid Corp.
Tel: 800-343-5000 (U.S.); 800-01-0119 (U.K.)
http://www.polaroid.com
Polaroid will send you any of a number of colorfully illustrated how-to pamphlets, as listed on page 177 of the Annotated Bibliography. To purchase the terrific *Instant Projects,* contact the Polaroid Collection at 781-386-2000. The video *Memories in Motion: Transforming Independent Film with Polaroid* shows how image transfers are used with 16 mm film; call 781-386-8115 to order. As long as the supply lasts, Polaroid will send teachers the free *Creative Uses Instructional Video,* which shows transfers and lifts being made.

Porter's Camera Store, Inc.
Box 628
Cedar Falls, IA 50613
They sell Porter's U-Spread Photographic Emulsion in 8 oz (236 ml) bottles and Liquid Light in 16 oz (472 ml) bottles; measuring cups; 4 × 5 in. (10 × 12.5 cm) and 8 × 10 in. (20.25 × 25.5 cm) Kodalith film; Kodak, Berg, and Edwal toners; Marshall's colors; McDonald's Protectacoat lacquer spray; Prisma color pencils; McDonald's color retouch kits; and a complete darkroom selection, including excellent choices of safelights. Write for their free (in the United States) catalog.

Process Materials
301 Veterans Blvd.
Rutherford, NJ 07070
Manufactures Archivart Standard sheets and Archivart Photographic Storage Paper.

John Purcell Paper
15, Rumsey Rd.
London SW9 0TR
United Kingdom
Tel: 0171 737 5199
Fax: 0171 737 6765
Fine collection of artists' papers.

Rockland Colloid Corp.
302 Piermont Ave.
Piermont, NY 10968
Makes Liquid Light, brownprint fabric (and paper) sensitizers, colorants.

Salis International
P.O. Box 3543
New Hyde Park, NY 10040
Distributor of Martin's Synchromatic Transparent Water C

Silverprint
12 Valentine Place
London SE1 8QH
United Kingdom
Tel: 071-620-0844
Fax: 071-620-0129
Materials and equipment for platinum and palladium pr salted paper, gum bichromate, etc. Will supply chemis small quantities. Very reasonably priced silver nitra brown printing. Specialty films.

Daniel Smith, Inc.
4120 1st Ave. South
P.O. Box 84268
Seattle, WA 98124-5568
Tel: 800-426-6740
http://www.danielsmith.com
Broad selection of papers, paints, Hake and other brushes arabic, and photo-etching zinc plates. Also carries inks, ers, brushes, and ink modifiers for making bromoil pri well as soft pastels for finishing them.

John Jones Stroud
Green Rd., Finsbury Park
London N4 3JG
United Kingdom
Tel: 0171 281 5439
Fax: 0171 281 5956
Art supplies, collection of Escoda brushes for bromoil.

Team Plastics
Tel: 800-931-8326
Ask for their laser acetate overhead transparent .004 pol film, also known as "copier film," to make transparenc your laser printer (check with the manufacturer of the printer first).

Universal Light Source
San Francisco, CA
Tel: 415-868-2880
Decent prices on Super Actinic 420-nm bulbs, which some tographers recommend for much faster and slightly mor trasty (cleaner high values) images with platinum and pa um printing.

Van Son of America
Union and Liberty Streets
Mineola, NY 11501
Manufacturer of gum arabic.

The Vermont Country Store
P.O. Box 3000
Manchester Center, VT 05255-3000
Tel: 802-362-8440
Fax: 802-362-0285
Believe it or not, they sell modern-day oilcloth, "still easy to wipe clean and won't crack" in domestic gingham, red berry, or mixed fruit pattern; it's great for covering the workspace. They carry citrus solvent, which works for solvent transfers. While you're at it, check out their Peanut Butter Goo Goos, too.

View Camera Store (formerly Darkroom Innovations)
P.O. Box 19450
Fountain Hills AZ 85269-9450
Tel: 480-767-7105
Fax: 480-767-7106
http://www.viewcamerastore.com
They sell the BTZS line, including developing tubes.

Vintage Image
6, Penwith Business Centre, Long Rock
Penzance, Cornwall TR18 2TD
United Kingdom
Tel: 0176 330200
Fax: 01736 352011
Platinum/palladium printing kits with instructions; ready-mixed chemistry, including bromoil; and small quantities of raw chemistry. They print *The Alternative Photo Review.*

Williams-Sonoma
Located in many large city shopping malls, they carry basting and pastry brushes good for bromoil.

Fabric Suppliers

Blueprints/Printables
1400-A Marsten Rd.
Burlingame, CA 94010-2422
Tel: 800-356-0445
Fax: 650-348-2888
E-mail: cyanoprint@aol.com
http://www.blueprintables.com
Fabric artist Barbara Hewitt and partner John Basye market pre-coated pieces of cyanotype fabric, and adult and youth T-shirts pretreated with cyanotype. You make the imagery. You can purchase Barbara's *Blueprints on Fabric* (see Bibliography) at a discount price, nature print transparencies (beet nos, lizards, dinosaurs, etc.), and untreated fabric fro company. Wholesale prices for stores, groups, and s Worldwide shipping.

Fabrics To Dye For
Two River Road
Pawcatuck, CT 06379
Tel: 888-322-1319
http://www.FabricsToDyeFor.com
They sell Setacolor light-sensitive dyes at a 40% discount notions, dye powders, and auxiliaries at 25% to 75% prepared-for-dyeing fabrics as well as hand-painted fa

Christine Manotti
Textile Resources
10605 Bloomfield
Los Angeles, CA 90720
Will send a catalog of supplies.

Pro Chemical and Dye Co., Inc.
P.O. Box 14
Somerset, MA 02726
Tel: 800-2-BUY-DYE (228-9393)
E-mail: pro-chemical@att.net
http://www.prochemical.com
They ship Pebeo fabric pens and natural fabric dyes an ener to prevent dyes from bleeding, which allows fo control when hand coloring. They carry Setacolor Tran Dyes for sun printing, as well as respirators, tough glov scales.

Siphon Art Products
365 Pittsburgh Ave.
Richmond, CA 94801
Tel: 510-236-0949
They ship Versatex textile paints.

Testfabrics, Inc.
P.O. Box 26
415 Delaware Ave.
West Pittston, PA 18643
Tel: 570-603-0432
Fax: 570-603-0433
E-mail: testfabrics@aol.com
http://www.testfabrics.com
Wholesale prices for individuals on desized, scoured, a pared-for-dyeing fabrics and on fabric swatch b Unsized 100% cotton, silk, and linen by the yard; tabl T-shirts, scarves; dust bunnies; accessories related tumes; translucent thread. On occasion, they sell cott onds on an as-is basis.

Glossary

agitate: To constantly rock materials in liquids to ensure even coverage.

aperture: The opening in a lens that adjusts and controls the amount of light allowed to pass through to the lens. Usually described as an *f/stop* or *f/number.*

archival: Having a quality of maximum permanence.

binary: A computer machine language that depicts letters, numbers, and symbols as sequences of the two digits 0 and 1, or as sequences of on and off.

blow up: To make an enlargement.

burning or **burning in:** Giving more light than the normal exposure to a selected area of the emulsion by shielding the rest of the emulsion from light. Burning usually makes that area darker; the technique often is used to retain more detail in the highlights.

chromoskedasic: Color by light scattering; used to describe a process whereby color chemicals are painted on black-and-white photographic paper.

color separation: The process of dividing full-color originals into the primary process printing colors: magenta, yellow, and cyan.

contact frame: See *print frame.*

contact print: A photographic image made from a negative or positive placed on the surface of sensitized paper, film, or a printing plate and exposed to light.

continuous tone: An image containing gradient values as well as the extremes of dark shadow and bright highlight.

contrast: Differences in tones in a picture.

copy: (1) Any furnished material or artwork to be used in printing; (2) in typography, written rather than visual image; (3) in electrographics, an interpretive print or reproduction.

correct reading: Facing the same direction as the original.

darkroom: A light-tight area, either completely dark or specially illuminated, for handling light-sensitive materials.

dense negative: A reversed-tone transparency so dark that it transmits very little light.

density: Measure of opacity of an image. The emulsion buildup in a negative or positive. Usually, the greater the exposure to light and the longer the developing time, the thicker the density.

developer: A solution rendering latent images visible after exposure.

digital: Electronic data representing information as numbers, based on discrete binary digits, for processing by a computer.

dimensional stability: The quality in a support of not changing its size by shrinking or stretching.

dodging: Holding back some light on an area of the emulsion during an exposure. Dodging usually renders that area lighter and often is used to retain more detail in the shadows.

duplicating film: Film that does not reverse the image but repeats it negative-to-negative or positive-to-positive. See *film.*

easel: The device, usually a metal frame, for holding light-sensitive materials flat under the enlarger during an exposure.

electrographics: The use of photocopy machines to generate art.

emulsion: A light-sensitive coating on film or paper.

enlarger: Equipment for projecting small transparencies to larger formats in a darkroom.

exposure: Subjection of a photosensitive coating to the action of light.

exposure unit: The source or system used to shine the appropriate light onto photosensitive emulsion.

eyeballing: Judging registration or exposure of images by visual inspection.

ferric: Substance that contains iron.

film: A light-sensitive material on a clear base.

fixer: A solution that removes unexposed silver halides (light-sensitive metallic compounds) from the emulsion and makes the image stable and impervious to white light. The amount of time the emulsion spends in the fixer is called the *clearing time.* Fixer is also known as *hypo.*

flat: The sheet of stripped-in negatives used to expose a photosensitive surface underneath.

fog: Density in the negative or print caused by errant light or chemical action not related to the normal formation of the image. See *safelight.*

f/stop: Fixed sizes or settings for lens apertures.

gelatin: A binder made from animal parts used as a support for the light-sensitive particles in certain emulsions.

generation: Each succeeding stage in reproduction from the original.

grain: (1) The direction in which most fibers lie in paper; (2) silver particles on film and paper, not usually visible unless viewed under magnification.

graphic arts film: A variety of orthochromatic films.

gray scale: A strip of standard gray tones ranging from black to white, used to measure tonal range and contrast.

heliography: An obsolete term for printing processes that depend on the sun (or ultraviolet light).

high contrast: An image or process that yields only black and white, or shadow and highlight.

highlight: The brightest light accents in the subject. Therefore, the lightest of whitest parts in the positive and the darkest areas of a negative.

hypo: An abbreviation of the obsolete term for the chemical sodium thiosulfate (hyposulfite of soda), used to fix the image on some photo emulsions after development. The term also refers to the baths compounded with it. See *fixer.*

laser printer: An apparatus used to transfer type and graphics from a computer onto a substrate ("hard copy"). Very strong light waves first draw the image, in the form of high-resolution dot patterns, onto a metal drum in the printer, which then electrostatically attracts dry ink powder to itself, in much the same manner as an office copier.

latent image: The invisible representation in the emulsion after exposure, later made visible by development.

layout: Drawing or sketch of proposed printed piece.

light table: Equipment used for viewing and preparing transparencies, consisting of a translucent glass or plastic top with lights below that shine through to illuminate the surface.

line: Processes and images that comprise black and white without intermediate gray tones.

line shot: High-contrast reproduction of original material.

lith or **litho film:** Also known as *orthochromatic ("ortho")* film because it is not sensitive to red light waves and is commonly employed in photolithography.

loupe: Magnifier for checking image details.

mask: (1) Opaque material used to cover selected image areas during the exposure; (2) the act of covering selected areas of an image during exposure.

matrix: A relief image for bromoil printing in which the raised part of the image is inked and transferred to a receiver.

mercerized: Treatment under tension with caustic soda to give cotton cloth more strength and receptiveness to dyes.

middle tones: Shades between highlights and shadows.

negative: (1) An image in which the values of the original are reversed (usually on film); (2) a process in which the tones are reversed.

nonrepro blue: Special blue marker that does not show when photographed.

opaque: (1) A condition in which no light is allowed to pass through; (2) special markers or paints that block light; (3) to block out unwanted areas on transparencies before printing.

orthochromatic: Photo surfaces insensitive to orange and red light but sensitive to visible blue and green light.

panchromatic: Photo surfaces sensitive to blue and green visible light and some of the red spectrum.

photogram: A photo image produced without using a negative or camera by allowing an object to cast its shadow directly onto the recording surface.

photosensitive: The quality of reacting to light through chemical action.

pigment: Particles used to give color, body, or opacity to a semiliquid artists' material.

pixel: In an image, the smallest dot of light that can be shown on a computer—or television—screen and adjusted or stored. The smaller and closer together the pixels, the clearer the image. The term pixel is short for "picture element." Pixels are often called dots, as in dots per inch (dpi).

pixelization: A video effect produced by dividing an image into groups of course square tile shapes, which display the averaged value of the picture elements they contain. See *pixel.*

positive: Photo surface containing an image in which the dark and light values correspond to the original subject.

posterization: Separate black-and-white negatives, each of which records either the highlights, the middle tones, or the shadows of the same image. In printing, usually each negative is used with a different color.

press type, press tape, press graphics: Materials with adhesive backings that will stick to other surfaces when pressed down. They can be used in making transparencies.

print frame or **contact printing frame:** A shallow unit, usually made of a wooden edge, a glass plate, and backing, for holding negatives in strict contact with the emulsion during an exposure. In practice, light shines through the top glass, through the negative, and onto the photo emulsion.

print washer or **siphon:** Equipment for the flow of clean water and the elimination of dirty water.

proportion wheel: Scale for computing percentage of enlargement or reduction.

rag paper: Paper made from the degeneration of linen and cotton, as opposed to wood pulp.

register: Fitting two or more images in exact alignment with each other, or repeating the same image on top of itself.

reversal: The basis of most photography, which is the conversion of a negative to a positive (or a positive to a negative).

right reading: See *correct reading.*

rubylith: A red adhesive paper, marker pen, or tape used to opaque or block out portions of an image during exposure.

Different manufacturers have different names for the same kind of product.

safelight: A special darkroom lamp used for illumination that does not harm certain sensitized materials. Image density resulting from too much exposure to a safelight is called *fog.*

saturated solution: A liquid and chemical mixture so concentrated that no more of the chemical can be dissolved in it.

shadow: The darkest parts of a positive; the clearest parts of a negative.

size: The glutinous material used to fill in the pores of surfaces such as paper or fabric.

sizing: (1) Treatment of paper or fabric that gives it resistance to the penetration of liquids or vapors; (2) see *size.*

stat camera, graphic arts camera, copy camera, or **process camera:** The instrument with which photographic transparencies can be made, consisting, at least, of a light-tight area for holding film, a lens to direct and focus the image, a place to put copy or original artwork, and a light source. Although there are differences between stat cameras and copy cameras, the terms are commonly used interchangeably.

stock solution: Main concentrate of liquid chemistry from which working mixtures are made.

stop bath: A solution that halts development of emulsion, usually acetic acid.

stripping: The positioning of negatives or positives on a flat prior to exposure.

super coated paper: In bromoil printing, a top coat of hardened gelatin on the sensitive layer of photographic paper.

support: The surface onto which an emulsion is coated.

tanning: In bromoil, tanning is a process whereby developer hardens the gelatin of the emulsion in proportion to the amount of silver deposited on it.

test strip or **test print:** A photosensitized support exposed to light and developed in a systematic way so that bands of different exposures indicate what the finished image might look like. A guide for determining the exposure of the final picture.

thin: A transparency of overall low density, or tending to be fairly clear.

transparency: An image that transmits light through part of it. A transparency can be in the negative or positive, handmade or photographic, and large or small (e.g., a photographic slide).

ultraviolet light: Electromagnetic radiation having a wavelength beyond the visible portion of violet in the spectrum. Sunlight is a common source of ultraviolet light.

vacuum frame: A glass and metal device employing an air pump for holding copy and reproduction material in place during exposure.

wetting agent: A liquid bath for film to help prevent dirt and water spots and to make the film attract less dust. It usually is the last bath the film touches in the development procedure.

white light: The visible spectrum of light, whether artificial or natural.

wrong reading: Facing the opposite direction from the original.

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